HELSINKI SCHOOL OF ECONOMICS (HSE)
Department of Accounting and Finance

THE IMPACT OF LIQUIDITY PROVIDERS

Evidence from Helsinki Exchange and Stockholmsbörsen

Finance
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ABSTRACT
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Objective of the study

This paper studies the impact of the Liquidity Providers on the market quality, trading, and share prices at Helsinki Exchange and Stockholmsbörsen. During the past few years or so these two exchanges have been offering listed companies a possibility to use Liquidity Provider services in share trading to increase their trading volumes and to improve the quality of trading. The research problem in this paper is whether the Liquidity Providers can contribute to the market quality and increase the liquidity of the constituent shares.

Data and Methodology

The data consists of daily trading and price information of 29 Finnish and 79 Swedish shares and related market indices, OMX Helsinki CAP Total Return Index and OMX Stockholm Benchmark Total Return Index. Data source is Thomson Datastream. The used event study methodology includes trading volume analysis, market depth analysis, market efficiency analysis and Cumulative Abnormal Return Analysis. The tests employed are common t-test and Wilcoxon Signed Rank tests.

References

References used in this study are academic articles and publications collected from various respected academic publications.

Results

The results are convincing. The analysis provides evidence that the liquidity providing system improves liquidity. Trading volumes increase in all samples together with deepening market depths. The improvement in liquidity is accompanied with enhancement in the market efficiency. The pre-even least liquid shares show strong positive abnormal returns which gives evidence of a liquidity premium. All in all, the liquidity providing system is capable of improving the market environment and increasing trading.

Keywords

Liquidity provider, Liquidity, Event study

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1. INTRODUCTION

The liquidity of securities, the relationship between volume of trading and changes in market price, has won increasing recognition as an element of investment strategy in recent years. Relatively high liquidity is deemed to be a desirable characteristic of a stock, especially for the institutional investor, who typically trades in large volume. Thus, firms can generally be expected to seek means of enhancing the liquidity of their shares. Satisfactory liquidity results in lower investment costs and, from the investors' viewpoint, simplifies the process of both buying and selling shares, thus reducing the risk. From the listed companies' viewpoint, liquidity is a key element in fair equity valuation. One of the supposed means of accomplishing this is using Liquidity Providers' services.

In its own words, OMX focuses on continuously creating the best possible conditions for efficient trading. Accordingly, the Stockholm Stock Exchange and the Helsinki Stock Exchange have introduced Liquidity Providers for share trading to improve the quality of trading. This enhances the markets' liquidity and reduces costs for investors. Companies wishing to improve the liquidity of their shares can benefit from the services of Liquidity Providers.

According to the minimum requirements the liquidity providing (also referred to as "LP" hereafter) must quote prices in at least four trading lots, on both buy and sell sides so that the prices do not deviate more than 4% from each other, calculated on the bid price. The prices shall be quoted at least 85 % of the time of the continuous trading as well as in the applicable opening and closing auctions. I exploit this new opportunity to investigate the effect of the liquidity providing on minimum price variation on bid-ask spreads, trading volumes, and overall market quality[1]. In more general sense, this paper examines the effect of the LP on the Helsinki Stock Exchange and Stockholmsbörsen and evaluates the possible benefits that may arise with them.

The efficient market hypothesis assumes that there are no frictions in the market whatsoever and the share prices reflect the real values of the companies without any distortion (see e.g.

[1] September 25, 2006 Helsinki Stock Exchange commenced trading with 1 share lots. The new rules require that a liquidity provider guarantees at least EUR 4 000.00 worth of both bid and ask side transactions.

Fama et al. (1969)). Accordingly, a firm's price in theory would be the summation of the future free cash flows discounted to the present time with the investors' required return for the given level of risk. However, in the real world there are several other factors that play a role in the price discovery of any given company. Such factors are taxes, transaction costs, spreads, asymmetric information and liquidity to mention a few. In this study I will look into one of them - the effect of liquidity on share prices and market quality.

A very interesting question for both financial economists and investors is whether investments in improving the market microstructure have positive value. Ceteris paribus, improved liquidity is expected to increase securities values because rational investors discount securities more heavily in the presence of higher trading costs. This proposition by Amihud and Mendelson (1986) has been empirically supported in various studies. Cross-sectionally risk-adjusted returns on stocks and bonds were found to be increasing in their illiquidity, measured by their bid ask spread (Amihud and Mendelson, 1986, 1989a, 1991a; Kamara, 1994). Amihud, Mendelson and Wood (1990) found that during the stock market crash of October 19th 1987, price declines were greater for stocks whose liquidity suffered most, and price recovery was greater for stocks whose liquidity subsequently improved. Further, there are many papers about market quality improvements due to market microstructure changes. Amihud et al. (1997) studied the Tel Aviv Stock Exchange where stock trading was transferred from daily auctions to a mechanism where the call auction was followed by iterated continuous auction. Pagano and Schwarz (2003) investigated the impact of closing calls on market quality at Euronext Paris. The results were in line with what was expected: as the trading became more straightforward, frictions diminished and the quality of the market improved.

Several indicators can be used to measure the liquidity of a company's shares. Three key measurements are turnover, order depth and the spread (the difference between bid and ask prices). The spread is significant to investors because it is an indirect transaction cost, the cost between buying and selling at any given time. The thinner the spread, the lower the transaction cost. Academic literature considers the spread to be a significant proxy for liquidity.

The research question is simple – has the liquidity providing system succeeded where it is supposed to, i.e. has it increased liquidity and improved market quality? If so, do the investors

assign value to this hypothesized market quality improvement? According to the efficient market hypothesis, the price discovery should be efficient and accurate despite of any external systems. For the companies contracting Liquidity Providers or planning to do so in the future, the results of this study may provide very interesting and important information.

The main hypothesis in this paper is that the implementation of a LP system in the Helsinki and Stockholm Exchanges will improve market quality as a whole and accordingly, I expect results of increased trading volumes as well as improved quality of trading.

The methods employed are very similar to those in the earlier studies on microstructure changes of stock exchanges. I conduct tests to examine a possible increase in trading and market depth. I also conduct a test to study whether the market efficiency has improved. This should be the case as market frictions decline. Finally, I will conduct tests to examine the changes in share prices to find out if there is value in the improvements that Liquidity Providers bring to the market.

In the next section I go through some earlier research related to the liquidity and market microstructure changes and the used methodology. In the third section I introduce the data and its properties as well as the empirical methodology I will use to study the research problem. In addition, I will present the hypothesis in more detail. In the fourth chapter I will introduce the empirical evidence. The rest of this paper is will concentrate on the empirical results and the discussion around them.

2. THEORY AND REVIEW OF EARLIER STUDIES

In this chapter I introduce the related academic literature. Liquidity is widely studied and the academic world holds quite a solid consensus on the subject. There are many research papers on market microstructure changes, which are theoretically very close to this study. This chapter lays the supporting theoretical framework which builds on those of earlier studies. The papers I introduce are in my opinion the most relevant for this study. Not surprisingly, many of them are papers that are frequently referred to in academic literature.

I introduce the prior work that is specifically related to my study starting with the papers concerning liquidity as a concept, followed by ones that are related to changes of market microstructure or of other aspects of the trading environment. After this I introduce papers concerning the effect of liquidity on market efficiency and discuss the event study methodology. This chapter concludes with analysis of the papers that have studied the same subject as this one.

2.1. Introduction to Liquidity

Liquidity is a complex concept. It is characterized by high turnover, or a high level of trading activity, in a company's share. High turnover, and thereby liquidity, is the result of the combination of a small spread and a high order depth. The spread is the difference between the bid and ask price, and order depth is the total volume behind the bid and ask prices.

Many indicators are used to measure the liquidity of a company's shares in academic literature. Three key measurements are turnover, order depth and spread. The spread is significant to investors because it is an indirect transaction cost – the cost between buying and selling at any given time. The tighter the spread, the lower the transaction cost for the investor. The order depth in turn shows how many shares an investor can buy or sell at a given price. A high order depth minimizes the risk for a negative price movement when buying or selling shares. A low spread and high order depth consequently mean lower costs for investors. Ceteris paribus, this combination lowers risk and makes a company's shares more attractive.

The concept of liquidity would be best described as the ease of trading a security. There are many sources of illiquidity. One of them is the set of exogenous transaction costs such as brokerage fees, order-processing costs, or transaction taxes. These occur in every trade that takes place on the market. Thus, a rational investor accounts for these fees every time he or she acts as an agent on the market. Moreover, he also has to consider the future costs of the bought security as well, i.e. all the related costs upon the future sale. Intuitively that would mean, that any one investor on the market gives - what he thinks is a fair price for a security based on these costs – and risks. Thus, these costs are taken into consideration in the expected returns.

The more risks are involved with the share, the higher is the required return and the lower the investor's fair price. If the price on the market is more than the deemed fair price, the investor is willing to sell and vice versa. The investor expects to achieve profits as compensation to the borne costs - the more there are costs, the higher is the expected profit and the lower the target share price. On the securities market, the previous sentence could be translated as the more there are costs and risks involved the less is an investor's fair price he is willing to pay for a security which translates into a higher required return. Now, if the liquidity – or illiquidity – appears as a risk or a cost for instance in terms of a large spread, then an investor will discount the share prices more heavily, that is, at a higher required rate of return for his investment because of the illiquidity. This proposition was first introduced by Amihud et al. (1986), which I will introduce in more detail in the next chapter.

One important dimension of liquidity is the market depth of a security. Market depth is the size of an order needed to move the market a given amount. If the market is *deep*, a large order is needed to change the price. In the context of liquidity, it can broadly be said that market depth is the ease of find a trading partner for a given order. Retail investors play only a small role in the markets since they are usually far too small agents to have any real effect on the market and on prices. But there are several agents on the market that can easily affect the market which stems from their sheer volume. These institutional investors tend to favor liquid shares for various reasons. Both the nature and the extent of their supply and demand interact to reduce price movement relative to trading volume. It is quite clear that institutional investors have good reasons to consider liquidity in formulating their portfolio strategies and, as a matter of policy, to avoid illiquid stocks. The associated dampening effect on demand can only act to lower prices of illiquid securities. The degree to which this effect is operative may

vary, however, with swings in the market. At the other end of the market depth spectrum fall closely held and/or very small firms - the securities of which are not favored by institutional investors. It has been suggested that institutional investors buy large capitalization stocks first as well as sell the small stocks first (see e.g. Vayanos and Vila (1999)). If so, major moves into and out of the equity markets by institutional investors may affect relatively illiquid securities differently than more liquid stocks. The effect, during a market upswing and heavy institutional buying, is suspected of causing price increases in less liquid securities to lag behind the general market movement. In contrast, during a market downswing and a general retreat of institutional investors from the equity market, price declines in less liquid securities might cause the overall market to dip.

One more problem with illiquid shares arises when there are no quotes on the market at all that is the case with many of the most illiquid shares in the Finnish and Swedish markets. Demand pressure arises because not all investors are present in the market at all times, which means that if an investor needs to sell a security quickly, then the natural buyers may not be immediately available. In the specialist market, as a result, the seller may sell to a market maker who buys in anticipation of being able to later lay off the position. The market maker, being exposed to the risk of price changes while he holds the asset in inventory must be compensated for this risk, i.e. inventory risk, – a compensation that imposes a cost on the seller. Therefore, when the payoff in the form of spreads is limited as it is with the Liquidity Providers, they have a natural need to closely monitor the companies they guarantee in order to keep their heads on the surface[2].

The demand risk stemming from the abovementioned demand pressure also has another aspect. Let's say that an investor has private information on the company and he is sure that the company's shares are going to crash due to the prevailing market situation. Obviously, he would like to sell the shares, but if there are no buyers on the market he is not able to do so unless he lowers the price until someone is willing to buy. This is an example of the basic law of supply and demand. He could avoid the associated delay by promptly selling the asset at the quoted bid price, which reflects a liquidation discount. Similarly, to avoid delays, a buyer can choose to consummate an immediate purchase at the seller's ask price, which is higher than the asset's current resale value. Thus, trading at the quoted bid and ask prices saves

[2] The minimum requirements of Liquidity Providing demand that the bid-ask spread is under 4% calculated from the bid price.

traders the associated delays and difficulties — but at a cost. The liquidity of an asset may thus be measured by its bid-ask spread (the difference between the dealer's bid and ask quotes), which represents the price of liquidity (or immediacy) services (Amihud and Mendelson, 1989a)

Another issue that has been under study for several years now is asymmetric information and the cost of acquiring knowledge. The fair price discovery of any given share requires that all investors would have availability to the same information about a company at the same timely manner. However, this is not the case in the real world. In order to achieve knowledge, an investor has to buy it or work to get it. This information gathering process results among other things in costs that are subsequently reflected in the share prices.

Asymmetric information has also another and maybe more straightforward interpretation. That is the fact that, trading a security may be costly because the traders on the other side may have private information. For example, the buyer of a stock may worry that a potential seller has private information that the company is losing money, and vice versa that the seller may be afraid that the buyer has private information that the company's share price is about to take off. Thus, trading with a better informed counterparty will end up with a loss. In addition to private information about the fundamentals of the security, agents can also have private information about order flow. For instance, if a trading desk knows that a hedge fund needs to liquidate a large position and that this liquidation will depress prices, then the trading desk can sell early at relatively high prices and buy back later at lower prices.

The earnings principle of Liquidity Providers drives Liquidity Providers to closely monitor the companies they guarantee. They are making money by buying low and selling high within the regulated 4% bid-ask spread limit. Therefore, it is in their best interest to know the fair price for the share and in their part diminish the problems arising from asymmetric information and promote the correct price discovery in the market. Most importantly they have the muscle to do so and may even have access to more accurate information about the companies they are guaranteeing than other parties. It is fair to assume that due to the presence of Liquidity Providers there is better and closer monitoring for a guaranteed company.

All in all, liquidity has wide-ranging effects on financial markets. In their paper "Liquidity and Asset Prices", 2005, Amihud et al. show theoretically and empirically that liquidity can explain the cross-section of assets with different liquidity, after controlling for other assets' characteristics such as risk, and the time series relationship between liquidity and securities returns. They argue that liquidity helps explain why certain hard-to-trade securities are relatively cheap, the pricing of stocks and corporate bonds, the return on hedge funds, and the valuation of closed-end funds. It follows that liquidity can help explain a number of puzzles, such as why equities command high required returns (the equity premium puzzle), why liquid risk-free treasuries have low required returns (the risk-free rate puzzle), and why small stocks that are typically illiquid earn high returns (the small firm effect).

All of the costs of illiquidity mentioned above should affect security prices if and when investors require compensation for bearing them. In addition, because liquidity varies over time, risk-averse investors may require a compensation for being exposed to liquidity risk. These effects of liquidity on asset prices are important. Investors need to know them in designing their investment strategies. And if liquidity costs and risks affect the required return by investors, they affect corporations' cost of capital and, hence, the allocation of the economy's real resources.

The presence of the Liquidity Providers should at least in theory lower the cost stemming from the illiquidity. Above, I shared the common knowledge of the costs of illiquidity with the reader. The fact alone that illiquidity is considered as a cost is enough grounds to make an assumption that market players should put value on removing it. In addition, based on the fact that the spread is considered to be a major factor of liquidity, by artificially diminishing the spread, should have a positive effect on trading volumes.

Above, the characteristics of the liquidity are explained mainly from the investors' point of view. However, the underlying companies also stand to gain. In the normal situation it is in any company's best interest that it is correctly priced on the market. The correct market price provides shelter against hostile takeovers, enables fair priced financing and prevents some other problems concerning corporate governance and corporate finance. However, corporate finance theory is far beyond the scope of this study and thus I leave further association of the subject to other topics to readers' interest.

The literature on liquidity is vast. In this paper I will concentrate more on those concerning the effects of market microstructure changes of the market. Accordingly, the rest of this chapter concentrates on the academic literature and their findings on liquidity and especially the factors influencing it. Surveys of liquidity and market microstructure changes such as Amihud et al. (1997), Pagano and Schwartz (2003), Ahn et al. (1996) suggest that changes in an exchange's microstructure can affect the market's liquidity, trading costs, pricing efficiency, and transparency. This study is closely related to those earlier studies on exchange microstructure changes and reductions in the tick-sizes of foreign exchanges. Some studies have concentrated on more drastic changes in the market environment. E.g. Cooper et al. (1985) studied the liquidity and stock performance when shares start trading in a completely new market and which in turn increases their liquidity by way of greater exposure. However, I find it adequate to introduce maybe the most profound paper on the liquidity and bid-ask spread first and some papers that build on the theory introduced by it.

2.2. The Interaction between Liquidity and Share Returns

The most profound work done under the subject is the paper by Amihud and Mendelson, 1986. Their paper studies the effect of securities' bid-ask spreads on their returns. They model a market where rational traders differ in their expected holding periods and assets have different spreads. The ensuing equilibrium had the following characteristics: 1. market-observed average returns are an increasing function of the spread, 2. asset returns to their holders, net of trading costs, increase with the spread, 3. there is a clientele effect, whereby stocks with higher spreads are held by investors with longer holding periods, and 4. due to the clientele effect, returns on higher-spread stocks are less spread-sensitive giving rise to a concave return-spread relation.

In their study they design a test on the behavior of observed returns, and find results that support the theory. The robustness and statistical significance of their results are very encouraging. They argue that their results do not point at an anomaly or market inefficiency; but rather, reflect a rational response by investors in an efficient market when faced with trading friction and transaction costs.

The higher yields required on higher-spread stocks give firms an incentive to increase the liquidity of their securities, thus reducing their opportunity cost of capital. Consequently, liquidity-increasing financial policies may increase the value of the firm. To illustrate this with figures consider for instance an asset yielding $1 per month with a 3.2% bid-ask spread and having a 2% opportunity cost of capital and value of $50. Their model estimates that if the spread is reduced from the mentioned 3.2% (their high spread group) to their low spread group's 0,486% the asset value would increase in value about 50% to $75.8. That should provide enough motivation for any firm to invest in liquidity improvements.

In their study they also tested for the well recognized firm size effect on liquidity by building a model where the natural logarithm of firm size was added to their model, where other two factors, β and spread, remained the same. Their results suggest that after the addition the β and spread prevail, whereas the size-effect is insignificant. In sum, their results on the return-spread relation cannot be explained by a 'size effect' even if the latter exists. In fact, any 'size effect' may be a consequence of a spread effect, with firm size serving as a proxy for liquidity. And, rather than suggesting an 'anomaly' or an indication of market inefficiency, their return-spread relation represents a rational response by an efficient market to the existence of the spread.

The results presented above are in maybe the most referred paper studying the spreads, share performance and liquidity. But there is a vast group of papers that post very similar results. For instance, Brennan and Subrahmanyam (1996) investigate the empirical relation between monthly stock returns and measures of illiquidity obtained from intraday data. They find a significant relation between required rates of return and these measures after adjusting for the Fama and French risk factors, and also after accounting for the effects of the stock price level.

Their main findings are that there is a significant return premium associated with both the fixed and variable elements of the cost of transacting. The relation between the premium and variable cost is concave, which is consistent with clientele effects caused by small traders concentrating in less liquid stocks. However, the relation between the premium and the estimated fixed cost component is convex. This is inconsistent with the horizon clientele effect proposed by Amihud and Mendelson (1986), and in their opinion may be the result of their inability to estimate this parameter accurately on account of price discreteness. Alternatively, it may be due to incomplete risk adjustment by the three-factor Fama and

French model they use. They also find that even after risk adjustment using this model there is an additional risk premium associated with an inverse price factor. There is no evidence of seasonality in the premiums associated with their cost of transacting variables. Finally, an interesting byproduct of their analysis is the finding that controlling for firm size, there appears to be a negative relation between the variable and fixed costs of transacting. They however, do not find an explanation but merely state that, "theoretical and empirical understanding of this phenomenon appears to be a fruitful area for future research".

Amihud (2002) presents new tests of the proposition that asset expected returns are increasing in illiquidity. The study follows the (at that point) well known fact that illiquidity explains differences in expected returns across stocks. The new tests of the paper propose that over time, market-wide expected illiquidity affects the ex ante stock excess return. This would imply that the stock excess return usually referred to as the 'risk premium', also provides compensation for lower liquidity of stocks relative to that of Treasury securities. And, expected stock excess returns are not constant but rather vary over time as a function of changes in market illiquidity.

The new tests of the effects of illiquidity over time show that expected market illiquidity has a positive and significant effect on ex ante stock excess return, and unexpected illiquidity has a negative and significant effect on contemporaneous stock return. The negative effect of unexpected illiquidity is because of higher realized illiquidity that raises expected illiquidity, which in turn leads to higher stock expected return. Then, stock prices ceteris paribus should decline to make the expected return rise. The effects of illiquidity on stock excess return remain significant after including in the model two variables that are known to affect expected stock returns: the default yield premium on low-rated corporate bonds and the term yield premium on long-term Treasury bonds.

The effects over time of illiquidity on stock excess return differ across stocks by their liquidity or size: the effects of both expected and unexpected illiquidity are stronger on the returns of small stock portfolios where most of the liquidity guaranteed shares would belong to. This suggests that the variations over time in the 'small firm effect' of the excess return on small firms' stock are partially due to changes in market illiquidity. This is because in times of illiquidity, there is a 'flight to liquidity' that makes large stocks relatively more attractive.

The greater sensitivity of small stocks to illiquidity means that these stocks are subject to greater illiquidity risk which, if priced, should result in a higher illiquidity risk premium.

The results suggest that the stock excess return, usually referred to as the 'risk premium', is in part a premium for stock illiquidity. This contributes to the explanation of the puzzle that the equity premium is too high. The results mean that stock excess returns reflect not only the higher risk but also the lower liquidity of stock compared to Treasury securities. The theories here build a solid ground for the premise that Liquidity Providers bring certainty to the market as they make the share less sensitive to liquidity changes. That in turn should lead in lower expected stock returns – or a higher share price.

Chordia, Roll and Subrahmanyam (2000) study commonality in liquidity. Even if the subject is only in distant relation to my paper I will go through their findings in order to shed more detailed light on the characteristics of liquidity. They claim that liquidity is more than just an attribute of a single asset. Individual liquidity measures co-move with each other. Even after accounting for well-known individual determinants of liquidity such as trading volume, volatility, and price, commonality retains a significant influence.

Recognizing the existence of commonality in liquidity allows uncovering evidence that inventory risks and asymmetric information both affect an individual stock's liquidity. A share's spread is positively related to the number of individual transactions but negatively related to the aggregate level of trading in the entire market. Their interpretation is that this pattern is a manifestation of two effects: 1. a diminution in inventory risk from greater market-wide trading activity, most plausibly by uninformed traders, and 2. an increase in asymmetric information risk occasioned by informed traders attempting to conceal their activities by breaking trades into small units, thus increasing the number of transactions. Although, commonality is the instrument used here to reveal asymmetric information effects on liquidity, they find no evidence that asymmetric information itself has common determinants. Co-movements in liquidity also suggest that transaction expenses might be better managed with appropriate timing. When spreads are low, managed portfolio turnover can be larger without sacrificing performance. However, they do not yet know whether common variations in trading costs are associated with other market phenomena, such as price swings, which might offset the benefits of time-managed trading.

Finally, an important research issue not investigated their study is whether and to what extent liquidity has an important bearing on asset pricing. Transaction expenses can accumulate to become a relatively large decrement in total return when portfolios are turned over frequently. If liquidity shocks cannot be diversified, the sensitivity of an individual stock to such shocks could induce the market to require a higher average return. A higher expected return would surely be required for stocks with higher average trading costs, as I explained in the fist sub-section of this chapter, but there might be an additional expected return increment demanded of stocks with higher sensitivities to broad liquidity shocks. Again the findings support my hypothesis that Liquidity Providers would provide firms with services that is in their best interests.

Above are presented only a tip of the iceberg when it comes to papers on liquidity. But not all authors support the ideas presented above. For instance Vayanos and Vila (1999) show in their article the effects of transaction costs on asset prices. They assume an overlapping generation's economy with two riskless assets. The first asset is liquid while the second asset carries proportional transaction costs. They show that agents buy the liquid asset for short-term investment and the illiquid asset for long-term investment. The price of the liquid asset increases, when transaction costs increase. The price of the illiquid asset decreases if the asset is in small supply, but may increase if the supply is large. They show that with transaction costs, agents first buy the illiquid asset, next buy the liquid asset, then sell the liquid asset, and finally sell the illiquid asset. For a short holding period transaction costs are important and the liquid asset is the better investment, despite being more expensive than the illiquid asset. For a long period transaction costs are less important and the illiquid asset is the better investment. As in Amihud and Mendelson (1986), each asset has its own clientele.

In addition, Constantinides (1986) is also a paper that does not consider spreads to be a major factor in the liquidity. He studied a partial equilibrium economy with two assets, a stock and a riskless security, and with proportionate costs of trading the stock. He formulates a two-asset, intertemporal portfolio selection model incorporating proportional trading costs. According to his results also demand for assets is shown to be sensitive to these costs. However, he suggests that transaction costs have only second-order effect on the 'liquidity premium implied by asset returns.

Further, Aiyagari and Gertler (1991) explore whether incorporating an explicit motive for holding liquid assets within an equilibrium asset pricing model helps explain the following features of asset returns and turnover in the post-war U.S. economy: 1) the low, risk-free real interest rate, 2) the large spread between returns on liquid assets and stocks, and 3) the greater transaction velocity of liquid assets relative to stocks. They introduce a demand for liquid assets by adding uninsured individual risk together with differential costs of trading securities. Numerical simulations attempting to match the return data generate a ratio of liquid assets to income considerably below the observed level.

The common factor in the three studies mentioned above is the fact that they consider transaction costs, i.e. spreads to be only a second-order effect on the liquidity. Their models are very complicated utility models, which try to derive an investor's total utility equilibrium for holding a portfolio of different kinds of securities. Even if they claim that transaction costs have only a second order effect on the liquidity, they all are unanimous of the fact that the transaction costs influence trading.

2.3. The Impact of Market Microstructure Changes

The crowd of studies concerning market microstructure changes is very wide. Many of them have a great consensus within their results. In this section I will introduce some of the work done in the field. The papers that study the changes in minimum price variation are introduced in the next section as they are the ones that relate to this study most closely. Nevertheless, the papers on market environment changes and their effect on liquidity are important as the theory behind them ultimately relates to any improvement on the market.

A paper by Amihud et al. 1997, examines the value effects of improvements in the trading mechanism. The survey is done on the Tel Aviv Stock Exchange (TASE) shares that were gradually transferred from a daily call auction to a mechanism where the call auction was followed by iterated continuous trading sessions.

The old auction method was conducted by human auctioneer until 1991. Limit and market orders were submitted to the investors before the opening or were retained by the brokers. Shares were called in a predetermined sequence by an auctioneer, who first announced the

shares' excess demand, positive or negative, at the previous close price and then changed the price based on the direction of excess demand. As the announced price changed, the excess demand decreased until equilibrium was reached. If equilibrium could not be reached, at a daily price increase of 10%, the stock was announced as 'buyers only' and the price was set at the previous day's price plus 5% without executing any order. After two days of 'buyers only', the price was allowed to move without bound. Price declines were treated analogously. All in all, the mechanism was very inefficient.

The new method, called the variable price method, was designed to increase liquidity and efficiency. Traders' ability to execute multiple transactions within the day mitigates the price impact of large orders. Traders can also correct the pricing errors after observing the transaction prices of the same and similar shares after obtaining additional market information that used to be unobservable. The improvements were in every way very significant.

Not surprisingly, in their paper they show that improvements in market microstructure are valuable. They found out that shares that were traded in a more efficient trading method experienced a significant and permanent price rise. To be more accurate, in their sample, the average cumulative abnormal return over the test period was about 5.5%. The results indicated a significant rise as the costs of improvement were quite modest. The cost of the system was estimated to be under $10 million. The 100 shares that were moved to the new improved trading method had an ex-ante market capitalization of $26 billion and experienced a gain of over $1.35 billion. The price rises were accompanied by significant increases in both market-adjusted volume and in the liquidity ratio indicating improved liquidity. The value gains were positively associated with the increase in liquidity. It must however be kept in mind that they studied a new system that improved the whole market structure and had thus very substantial effects on price discovery, liquidity and overall market quality. Therefore, I would not expect as drastic results in my paper.

One of the oldest papers in the field is done by Cooper et al. 1985. The paper examines the relationship of common stock liquidity to both exchange listing and price behavior during major up and down-movements on the market. The results are quite interesting.

Their main findings are as follows: First, their results show that the liquidity ratio tended to increase with market value and share price. However, the relationship was not in lockstep. In

each of their market size-based deciles, the range of liquidity ratios was very wide.[3] Thus they argue that, while size and price serve as gross proxies for liquidity, the exceptions are frequent enough to justify the information content of liquidity ratios and to explain why large investors are willing to pay for liquidity information.

Maybe the more interesting results stem from research on betas in the market up- and downswings. They report concrete evidence on the share price reaction behavior during the bull and bear markets. These results suggest that the liquidity of securities may affect their systematic risk relationships in a manner which differs somewhat from the risk-return norms prescribed by the capital asset pricing model (CAPM). In addition, the empirical findings indicate that liquidity may have a significant bearing on the degree of security price response to market upswings as compared to downswings—a phenomenon that might be attributable to both institutional arrangements and investor behavior. The results are supported in Amihud, Mendelson and Wood (1990), who found that during the stock market crash of 19 October 1987, price declines were greater for stocks whose liquidity suffered most, and price recovery was greater for stocks whose liquidity subsequently improved.

Baker and Khan (1993) studied the effect of dual trading through unlisted trading privileges (UTPs) on liquidity and stock returns. They argue that the differences in market structures affects stock returns through liquidity and services provided by the competing markets. They compared 852 AMEX and NYSE firms that began unlisted trading on the Philadelphia, Pacific, Midwest or Cincinnati exchanges between 1984 and 1988. Their results show significantly positive returns around SEC announcements of regional exchanges filing for UTPs. The evidence suggests the initial news of UTPs trading had positive, short-term valuation implications for existing shareholders. Moreover, they conclude that their evidence that interdealer and intermarket competition are positively related to liquidity, and that liquidity is positively related to share returns suggests that increased competition among specialists and markets is desirable for improving the transactional efficiency of equity markets.

[3] Amihud and Mendelson (1986) tested for the significance for the firm-size factor in their model and found out that firm-size is not significant in their model. They argue that any 'size effect' may be a consequence of a spread effect, with firm size serving as a proxy for liquidity.

Many other authors have found results similar to those above in the case of market microstructure changes. The general result is that a market improvement that efficiently decreases frictions in the market could lead into an improvement in liquidity and that this increased liquidity would then be associated with a positive price reaction. Accordingly, I am waiting to get results that are similar to those. In the next section I introduce some work done on the minimum price variation.

2.4. The Minimum Price Variation and Liquidity

So far it seems to be quite obvious that by improving the market environment the liquidity improves alongside. Liquidity Providers' main means of improving liquidity is the quote guarantee on the market and the minimum price variation, i.e. a limited spread. In the past decade, many stock exchanges have reduced their tick sizes or totally altered their pricing to use of decimalization instead of tick-sizes. I find these studies to be really close to my study because of the fact that in both cases the major change is concerning spreads.

One of the first and most well known papers in this field is the one by Harris (1994). In his study he develops a cross sectional model for the discrete spread and uses the estimated model to predict the reduction in the spread, the change in $1/16 quote frequency, trading volume, and market depth once the tick size is reduced from $1/8 to $1/16. The data consists of NYSE and AMEX shares in 1989. The starting point for this study was the assumption that the minimum price variation will affect trading volume if it forces dealers to quote a larger spread than they would otherwise quote. Large bid-ask spreads make trading expensive.

The study presents several empirical analyses of spreads, quotation sizes and trading volumes. The study uses standard and switching regression analyses to explore how price levels are related to average spreads, quotation sizes, and trading volumes. The estimated regression models are then used to project how quotation sizes and trading volumes would change if the traders could use smaller tick-sizes. In addition, a model with discrete bid-ask spreads is introduced which is used to evaluate how quoted spreads would change given a different minimum price variation.

The results are convincing. According to the results, a decrease in the minimum price variation from \$1/8 to \$1/16 would result on average in a 36 percent spread decline for the stocks priced under \$10. At the same time, the displayed size at the narrowed inside quotations for these shares would decrease 15 percent. Even though I am not dealing with quite the same subject; the major determinant, decreasing spread[4], is the same and thus I am waiting the results to be quite similar to the ones in the Harris (1994) study.

Ahn et al. (1996) studied the actual tick-size reduction from \$1/8 to \$1/16 in 1992 when NYSE and AMEX lowered their minimum price variation. It is the first paper to test and evaluate the Harris (1994) model and is therefore a critical paper in the literature on the topic of minimum price variation.

The results suggest that the Harris (1994) model has its flaws. Even though the displayed and inside quotations declined in their paper, the reduction was much smaller. They came up with results that post a decline of 19 percent in both the quoted and effective spreads of the most actively traded shares. The least traded shares experienced only a 4% decline in their spreads. The proportion of spreads quoted at increments of \$1/16 increased from nothing to 28%, and the spread quoted at \$1/8 decreased from 72 to 51%.

The declines in spreads, however, were not associated with increased trading and deepened market depth. In those parts the results contradict with the findings of Harris (1994). The results in Ahn et al (1996) show that the trading volumes increased after the tick-size reduction but the increase was also reported for the group that did not experience a tick-size reduction. Therefore, they reject the possibility of a tick-size reduction of being the source of this increase in value. The differences between the control group and the sample group were not statistically significant. Thus, they argue that the increase in trading would be related to common factors such as a time trend, rather than caused by the tick-size reduction[5].

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[4] In the Harris (1994) the minimum tick size was lowered from \$1/8 to \$1/16 giving traders the possibility to use lower tick sizes. In my study the upper level of the tick size is predetermined. Spreads however decreased in the Harris study and the impacts on the market quality are much the same.

[5] In my study the starting dates of trading with liquidity providers are spilled in the course of about three years. Therefore, time trends and common factors are self-excluded in this study.

In his paper, Jeffrey M. Bacidore (1996), studies the impact of decimalization on market quality on the Toronto Stock Exchange. The starting points are quite different to the previous two studies. First, the study is an event study whereas Harris made a prediction model. Second, Ahn et al. studied only a small range of shares, i.e. shares that were trading between $1 and 5$. Bacidore's study is made on the largest and most active Canadian exchange avoiding the problems of 'quote matchers' and the 'competition effect'[6].

His main findings are as follows. First, for shares trading above €5, the bid-ask spreads, quoted and effective, decreased significantly after decimalization. This decline was significantly related to stock price and trading activity. Second, the average daily volume for the period following the move to decimal pricing did not increase significantly. That would mean that Liquidity Providers would have been adversely affected. Finally, along the lines of Ahn et al. (1996), the study finds that the Harris (1994) model tends to overpredict the decline in spreads following a reduction in the minimum tick size.

The abovementioned studies on tick size reduction raise many issues concerning my study. The most evident is the impact on trading volume and thus liquidity. The previous studies found that even if the spreads declined, the trading volume was untouched. Would that mean that spread declines do not have any influence on trading volumes and therefore, liquidity? I would argue that even if the external essence in my paper is quite similar, i.e. the effects are mainly due to the lowered spreads, the results could vary from the ones presented above. The main reason behind my reasoning is that in my study most of the shares are really illiquid. They are subject to infrequent trading and substantially large spreads. In fact, there may be days that there are no quotes on the market at all. Therefore, trading with them has been not only expensive but also difficult (if not impossible). The studies above are done on the markets that are already fully functioning and satisfied markets meaning that the money available for the market is already there. Therefore, aggregate changes would have little effect, if at all, on liquidity, given that the money available for the market would not be increased at the same time. And, finally, as it has been presented already earlier in this paper, the institutional investors may increase their interest and ownership in these liquidity guaranteed shares.

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[6] Harris (1994) argues that a reduction in tick-size could lead to lower depth as market makers hide more of their orders to avoid "quote matchers" that would decrease their profits. The competition effect (se e.g. Khan and Baker, 1993) proposes that competition between market makers in dual listings would result in an improvement of the transactional efficiency of equity markets.

2.5. Market Efficiency

Liquidity and market efficiency has been brought up in many recent papers. The concept of market efficiency is usually understood as the lack of market frictions on trading. Another way to view market efficiency would be to describe the market along the lines of efficient market theory. Any frictions, such as trading costs, taxes, holding cost or even costs stemming from acquiring information, are considered to drive the market further away from efficient markets. Naturally, liquidity is one factor.

The presence of Liquidity Providers on the market should in theory have an effect on the market efficiency as they first of all guarantee that the trades at all can take place. Furthermore, they help diminish the costs involved in trading. Many papers exist about market quality improvements due to market microstructure changes. Amihud et al. (1997) studied the Tel Aviv Stock Exchange where stocks were transferred from daily auction to a mechanism where the call auction was followed by iterated continuous auction. Pagano and Schwartz (2003) investigated a closing calls impact on market quality at Euronext Paris. The results are as expected. As the trading becomes easier, frictions diminish and the quality of the market improves. Next I will introduce these papers in more detail.

In Amihud et al. (1997), they argue that movement from a 'call auction method' to 'variable method'[7] should enable investors to incorporate information into the share price more quickly and with greater precision. Therefore, under the variable method, the pricing errors relative to the contemporaneous market index should be smaller because of both faster adjustment to changes in the market index and smaller firm specific errors given the information available from the observed prices of the same related shares.

They test possible improvement in market quality with a Relative Residual Dispersion-method, first introduced by Amihud and Mendelson (1989b, 1991b). The method is based on the variance of returns across securities, as a descriptive indicator of the efficiency of a trading mechanism. The variance is the market model error term. According to their results, the improvement in the market microstructure had a positive effect on market quality. Their results posted improvement in market efficiency for 78% of the sample shares and the results were statistically significant. The results support the fact that improvements in the market

[7] Amihud and Mendelson (1997) is introduced in more detail in chapter 2.2.

microstructure would have positive effects on market quality. As the return variance becomes smaller it also reduces the measurement of risk, i.e. volatility.

Pagano and Schwartz (2003) study the closing call's impact on market quality. Even if the paper does not handle liquidity directly, the findings on market microstructure improvements are interesting. A call auction differs from continuous trading in the following way: in a continuous market, a trade is made whenever a bid and offer match or cross each other, whereas in a call auction, the buy and sell orders are cumulated for each stock for simultaneous execution in a multilateral, batched trade, at a single price, at a predetermined time. By consolidating liquidity at specific times, a call auction is intended to reduce execution costs for individual participants and to sharpen the accuracy of price discovery for the broad market.

They also keep the market model as a starting point for their tests. They however, do not study the price variance but the market model's explanatory power, R^2. They show that R^2 increased in all measurement intervals suggesting that the market efficiency has increased. They conclude that while the market efficiency has improved, the closing call has lowered the costs for individual participants and sharpened the price discovery of the broad market.

Chordia, Roll and Subrahmanyam (2006) study liquidity and market efficiency. They argue that for stock prices to fluctuate randomly, the market must absorb order imbalances in a timely manner. Further, it stands to reason that market efficiency is not immune to frictions, such as illiquidity, that are barriers to efficiency-creating arbitrage activity. They examine how the capacity of the equity market to absorb imbalances varies through time and across different liquidity regimes. The analysis relies on a sample of the NYSE stocks that traded every day during the 1993-2002 decade.

Their paper provides ample evidence that order imbalances do indeed predict future returns over very short intervals, more so for the smaller firms. But the extent of this predictability declines over the sample period. Liquidity plays an important role in the maintenance of market efficiency. The market's ability to absorb order imbalances is greater in liquid periods than in illiquid ones. The microstructure literature also considers the notion of informational efficiency, which is defined as the amount of private information revealed in prices. Chordia et al. (2006) shed light on this concept of efficiency by considering per hour open-to-

close/close-to-open variance ratios. Variance ratios generally increased while first order return autocorrelations declined as the minimum tick size was reduced. That pattern is particularly strong for the smaller firms. Taken together, these findings suggest that the observed increase in open-to close/close-to-open variance ratios is not due to increased mispricing in the lower tick size regimes, but is consistent with an increase in the amount of private information that is incorporated in prices following the secular decrease in bid-ask spreads accompanying the lowering of the tick size. In sum, it appears that improved liquidity stimulates a higher degree of informational efficiency as there is more trading on private information following a reduction in the tick size.

The presence of Liquidity Providers in the Helsinki Exchange and Stockholmsbörsen certainly will have effect on the informational efficiency. As I have described before it is in the Liquidity Providers' best interest to know the fair price for the company they are guaranteeing. If they do not, they really lack the ability to make profits – as well as the ability to avoid losses. Therefore, the observed market price, the one quoted by the Liquidity Providers, should decline the problem of privately held information and enhance price discovery. In addition, I assume that a spread decline and the quote guarantee are significant enough improvements to have an enhancing effect on market efficiency.

2.6. Cumulative Abnormal Returns and Some Issues about the Methodology

A very interesting question for both financial economists and investors is whether investments in improving the market microstructure add value. Ceteris paribus, improved liquidity is expected to increase securities values because rational investors discount securities more heavily in the existence of higher trading costs. This proposition by Amihud and Mendelson (1986) has been empirically supported in various studies.

The method used to study the possible price rise is first introduced by Fama, Fisher, Jensen and Roll (1969). It is widely used in the event study papers to study if an event has impact on the value of underlying securities. The common market model is based on the Capital Asset Pricing Model or CAPM. The model is used to examine the share returns around the event-date. The model is presented in more detail in the next chapter.

The event study methods have remained quite unchanged in past literature. Brown and Warner (1980) discuss about event study methods in their paper. Their goal in the study is not to introduce different kinds of methods but to find the best method for conducting an event study. They compared different event study-methods to reveal the abnormal price behavior around the event date by simulating the market. Their main findings were that there really is not a large deviation from one method to another. However, they did not have the opportunity to compare Fama, Fisher and Jensen three factor model as it was introduced to the public in the early 90's.

In simplified terms, the Three Factor Model punishes stocks classified as small-cap or value (defined as a stock with a high book value to market value). Fama and French are strong supporters of the Efficient Market Hypothesis. They believe that you only get excess return for taking on extra risk. Thus, if small-caps or value stocks have a higher than average return, then they must be riskier. The model is widely used in academic literature to study abnormal returns.

Dimson (1979) is a paper studying beta-bias with illiquid shares. He finds out that the shares subject to infrequent trading have downward biased betas. The major source of bias is the tendency for prices recorded at the end of a time period to represent the outcome of a transaction which occurred earlier in or prior to the period in question. Fisher (1966) pointed out that this causes an index constructed from such share price data to be an average of the temporally ordered underlying values of the shares. Consequently, positive serial correlation is induced into returns which are calculated from the index and the estimated variance of returns on the index is biased downward.

Shares which suffer from non-trading also have their covariance with the market substantially underestimated. The downward bias in the covariance of frequently traded shares is, however, much smaller. Thus, infrequently traded securities have a beta estimate which is biased downwards, while the figure for frequently traded securities is upward biased. It is the objective of that article to present a method for obtaining an unbiased estimate of the systematic risk of a share, when the share and some or all of the securities in the market are subject to infrequent trading.

I, however, find it sufficient to use the common market model. The rationale behind it is the fact that it is widely recognized method in the event study-methodology. Moreover, the additional accuracy that the Three Factor Model could bring is not essential for the purpose of my study. In addition, Amihud and Mendelson (1986) tested for the well recognized firm size effect on liquidity. They built a model where the natural logarithm of firm size was added to their model while their original other two factors, β and spread, remained the same. Their results suggested that after the addition the β and spread prevail, whereas the size-effect is insignificant. That could mean that the return-spread relation cannot be explained by a 'size effect' even if the latter exists. In fact, any 'size effect' may be a consequence of a spread effect, with firm size serving as a proxy for liquidity.

The results in Dimson (1979) would suggest that there should be some beta correction made at least for the least liquid shares. I, however, find it sufficient to use the basic beta of the common market model in evaluation of abnormal returns. The correction of the bias in the betas leaves room for another study and would require expertise in that field. In my context it would not be reasonable to do since it would not bring enough value added to the study. Moreover, the post-sample betas could be different from the pre-event betas, already due to the fact that the liquidity improvement could alter market risk.

2.7. Papers on Liquidity Providers

Anand et al. (2005) study the impact of Liquidity Providers in Stockholmsbörsen, They perform their study on 50 previously illiquid firms that contracted for market making services provided on the Stockholmbörsen. The study is similar to this one.

Their main findings are that spreads narrow by a statistically significant amount following the initiation of market making services. Their additional tests suggest that the decrease in spreads is not due to confounding factors. They also find evidence of market depth increases. Accompanying the increase in depth, they found a significant increase in average trade size, suggesting that traders no longer find it necessary to break up their orders to accommodate low market depth.

Accompanying the increase in depth, they also found evidence of a statistically significant decrease in return volatility. The decrease is found following the start of market making activities for both intra-day and inter-day return volatility. That would suggest that Liquidity Providers prevent orders from walking the book, in a manner very similar to that found for NYSE specialists. They also found that trading activity increases following the contracting, suggesting that Liquidity Providers are actively engaged in trading with public customers. Further, they found evidence that the average CAR for 10 days after the contract start date is a statistically significant 6.19%. According to their statistics the CARs were inversely related to spread improvement, suggesting that the CARs are not the result of a market wide trend. In addition, they examined LP firms' trading profits and found no evidence of compensation other than the contract fees. Summed up, these findings suggest that firms may benefit from taking a proactive role in the market making of their securities and that this decision is no different than other projects a firm faces.

The findings above are also consistent with other papers concerning the subject. For instance Glosten (1989) emphasizes an alternate rationale that the liquidity providing may prevent market failures by supplying liquidity during periods when the limit order book is thin.

Mann et al. (2002) study a sample of 19 firms of medium-to-high liquidity and 37 firms of low liquidity for which a liquidity providing system was introduced by the Paris Bourse between 1995 and 1998. They conducted an event study to analyze cumulative abnormal returns around the introduction of the liquidity providing system. They estimated cumulative abnormal returns (CAR) over an event window that began five days before the Liquidity Providers' announcement date and ended 10 days after the stocks started trading with a Liquidity Provider. For the illiquid sample, they found a statistically significant CAR of 4.4% during the event window; however, for the liquid sample, the CAR was not statistically different from zero. They also found support for the Glosten (1989) hypothesis that a designated market-maker may prevent market failure. They also found that a decrease in the probability of market failure is associated with a statistically significant positive return around the adoption of a Liquidity Provider, which supports the link between trading costs and required returns.

Kehr et al. (2001) provided an analysis of the specialists' function and their impact on the market outcome. Their data set enabled identifying the trades that specialists make on their

own account. Accordingly, they could eliminate these trades and determine the price that would have been obtained without the specialist's participation. Comparing this resulting series of hypothetical prices to the actual transaction prices, they found that specialist participation reduces return volatility which is consistent with the results in Anand et al. (2005). A further analysis showed that the actual prices are closer than the hypothetical prices to the surrounding prices of the continuous trading session. These results indicated that the specialists provide a valuable service to the market. To assess the cost of this service they calculate the specialists' trading profits and found them to be indistinguishable from zero. Their compensation thus appeared to be restricted to the commission received. The results are then in accordance with Anand et al. (2005) and Madhavan and Panchpagesan (2000).

Madhavan and Panchapagesan (2000) analyzed the NYSE opening auction and found that specialist participation enhances price discovery and reduces return variability. The returns earned on the specialist's transactions are "relatively modest" (Madhavan and Panchapagesan, 2000, p. 655), though significant.

Nimalendran and Petrella (2002) find an improvement in market quality on the Italian Stock Exchange after specialists were introduced for thinly traded stocks. However, they limit their study to the NYSE framework which is not directly applicable to this paper, as the "specialist" in our study differs in very fundamental ways from the NYSE specialist. Nimalendran and Petrella (2002) do not analyze the effect of specialist introduction on the cost of capital for the firms entering into market-making.

2.8. Conclusion of the Literature Review

The literature presented above is only a fraction of all of the literature related to liquidity as the liquidity is a widely studied area. The past literature has found concrete evidence that the spread plays a significant role in liquidity. There prevails a common knowledge that the investors discount shares with large spreads more heavily and makes the expected returns of those shares higher. Therefore, I expect to get evidence of increased share values, at least where the liquidity improvement is the greatest. I also argue that the market environment of the participating shares will change drastically as the spreads go down and as the quotes and trades are to some extent guaranteed.

Many of the shares in my sample are already very liquid and trading with small spreads. Therefore, the results for them could be most closely related to the earlier studies of tick-size reduction or decimalization, which suggest that while the spreads go down there still is no evidence of increased trading or deepened market depths. However, in those studies the market was fully functioning before the changes in spreads, and therefore the reduction in spreads, at least in theory, would only increase the trading volumes in that part that the money is saved in the spreads, i.e. the money available for extra trading.

In my study the illiquid shares are the shares that have faced significant problems in trading volume and in the form of large spreads. Many of them had pre-event spreads of over 10% making them unattractive for investors. Accordingly, there may have not been quotes at all on the market for days. Particularly institutional investors prefer liquid shares over illiquid ones. In addition, the least liquid shares tend to be small firms that face other problems such as asymmetric information.

There are some prior papers concerning the impacts of Liquidity Providers on the market. All of them (at least the ones I found) have found positive market reactions due to the implementation of liquidity providing system. They are also in accordance with other theories, such as the liquidity premium introduced by Amihud et al (1986). Accordingly, those papers have found evidence on declined spreads, reduced volatility, increased trading volumes and abnormal returns. The paper on the impact of Liquidity Providers in the Stockholmsbörsen is naturally really close to my work. I however have a larger data set with Finnish shares alone. I am waiting to get results similar to those in this paper.

3. DATA AND DESCRIPTIVE STATISTICS

In this chapter I will introduce the data and discuss some aspects of it. I will also include the spread analysis in this chapter as the further study of spreads is very limited. The data is on closing spreads. I will start by introducing the data and selected aspects of it. Then I will go into spread analysis. Finally I will introduce sampling rationale.

3.1. Data

The data consists of 108 shares traded on the Helsinki Exchange and Stockholmsbörsen. The participating shares have all made a contract with some Liquidity Provider. The only criterion I have set for the companies is that they have data available for 100 days before and after the event. The data source in this study is Thomson Datastream.

The Copenhagen Stock Exchange, also part of the OMX-group, supports Liquidity Providers as well and has provided guidelines for entering into Liquidity Provider agreements. Furthermore, the Copenhagen Stock Exchange requires a spread of not more than 2 percent to enter the MidCap+ segment and a spread of not more than 4 percent to enter the SmallCap+ segment. In addition, there are requirements for turnover, etc. Many companies have signed up with a Liquidity Provider to comply with these requirements. I, however, do not have information on Danish companies taking advantage of Liquidity Providers nor the dates of implementation. Therefore, this study excludes Danish stocks.

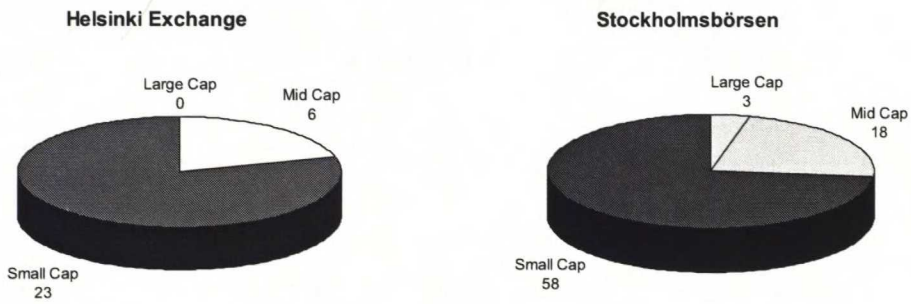
The original data consisted of 121 companies. 12 of them had to be excluded as they did not have data available for the whole event period. That left me with a sample consisting of 3 Large Cap shares, 24 Mid Cap shares, and 81 Small Cap shares of which 29 are Finnish and 79 are Swedish shares. Detailed information of the participating shares is listed in Appendix A.

The study concentrates on trading activity, spreads and returns. For this purpose, I have collected daily closing prices, spreads, and trading volumes for all the shares in the sample from 2002 to today. I also have total return indices for all shares to mitigate the effects of corporate actions, such as dividends and mergers from the sample. In addition, I have relevant

market information for the corresponding dates. In the following subsections I will go through the data validation and data sampling in more detail.

Figure 1.

Composition of the liquidity guaranteed shares based on their market capitalization is presented below.



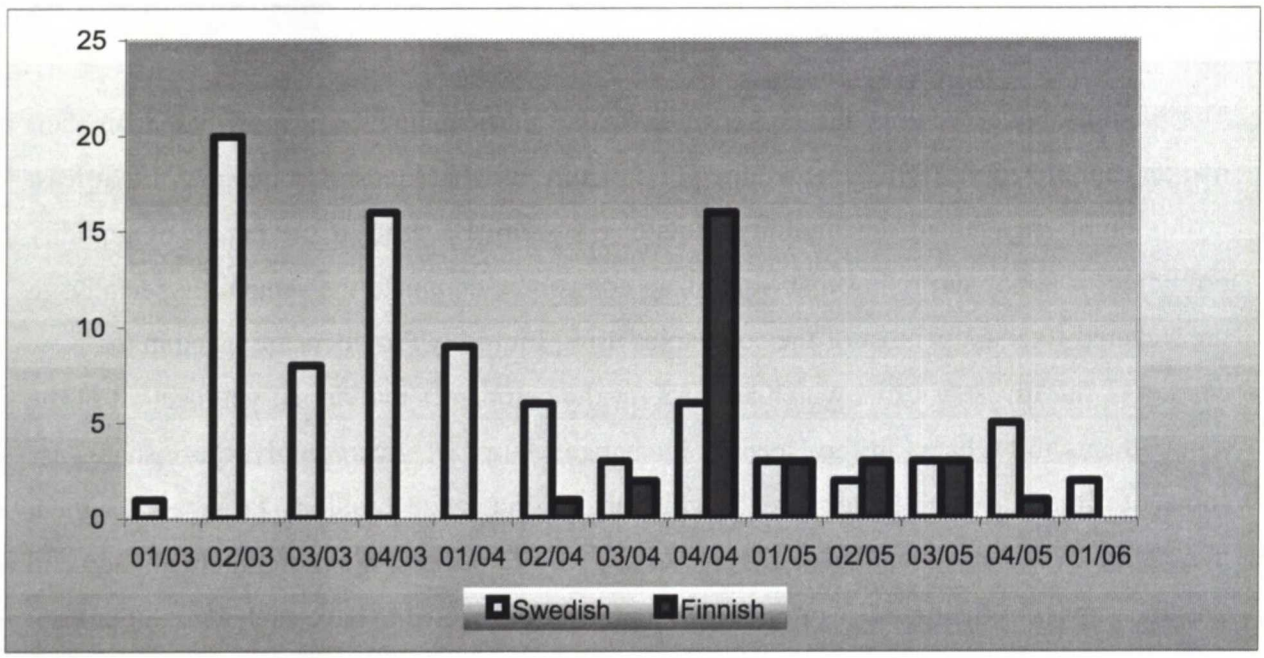
The picture above presents the composition of the participating companies based on their market capitalization. It gives us a quite good picture of what kinds of companies are at least at this point engaged in the liquidity providing system. Because of the nature of liquidity providing, it is not surprising that Small Cap companies dominate the sample. Especially, in the Helsinki Exchange, most of the companies using Liquidity Providers are listed in the New Market or the Investor's List which are lists for the companies that do not yet meet all of the requirements to be listed in the Helsinki Exchange Main List. Accordingly, those shares are subject to illiquidity and larger spreads which makes the use of Liquidity Providers for them more attractive. Subsequently, the Large Cap and Mid Cap shares are more liquid already and thus the impact of the liquidity providing system is not expected to have such a sizable impact on their trading volumes and spreads as on their less liquid counterparts.

The share data is collected around the event date. In Helsinki, the participating shares announced the Liquidity Provider deals on the same day as the liquidity guarantee commenced. The information is published in the form of an exchange company notice. In addition, a marker "LP" was added to the official list to indicate that a share has a Liquidity Provider.

In Sweden, the announcement is done in a different manner. Similarly, the liquidity guaranteed shares get a marker on the official list starting from day one. The announcements however, are released arbitrarily. Usually companies announce them one trading day before the first contract date, while some make the announcement a couple of days later. Therefore, I will use two d-days in my graphical presentations; I will be using the announcement date when trying to capture abnormal returns around the event and first trading day with the liquidity guarantee to graphically show the change in trading volume. In other models I use a closed window around the event date in order to exclude any abnormal behavior from the results.

Figure 2.

The quarterly development of the amount of the participating shares until Q1 2006.



In the figure 2 above is the quarterly development of the amount of the participating shares. It can be seen that the LP-system was introduced in the Stockholmsbörsen about one year before it was introduced in Helsinki. The patterns, between these two stock exchanges, slightly differ from each other. In the data property's point of view, the main concern is the quarterly deviation of the new deals across the calendar year. It is an important issue because I have to decide if any control variables are needed to be included in the models to control for overall market movement. From the picture above it is fair to say that the development is evenly enough spread for this study.

Most Finnish and Swedish shares pay out their dividends in the spring time. As shown in Figure 2, the first halves of the years do not dominate the sample. However, I find it adequate to adjust the share prices for dividends. In addition, all data is adjusted for all relevant corporate actions, such as splits and divestitures and so on. The total return indices for each share will serve this purpose. This data is readily available from Thomson Datastream database. These total return indices are calculated as all profit distribution reinvested in the underlying share. In addition, the share indices are adjusted for any corporate actions, such as splits.

The indices I will be using to describe overall market movements are OMX Helsinki CAP Total Return Index and OMX Stockholm Benchmark Total Return Index.

In Helsinki it is very important to use a portfolio index that limits the weight of any single company. The reason is the dominant role of Nokia in the HEX. The general price index usually correlates to a great extent with Nokia's share price. In order to exclude Nokia's - or any other player's for that matter - dominant role, I will use HEX portfolio total return index. OMX Helsinki CAP Total Return Index consists of all the main list shares. The weight of the constituent stocks is based on the market value adjusted by the free float, which means that only the part of the share capital that is considered available for trading is included in the index. In Hex Portfolio Index the maximum weight of any company is 10% of the index portfolio. That means no one individual share can not dominate the index.

Even though there is a larger base of companies in Stockholm and there may be less bias in the general index due to the lack of one prominent company, I will use a similar index to OMX Helsinki CAP for Swedish shares also. The OMX Stockholm Benchmark Index consists of the 80 to 100 largest and most traded stocks, representing the majority of sectors. In this Index, the weights of the constituent stocks are also based on the market value adjusted by the free float. The index serves as an indicator of the overall trend on the Stockholm Stock Exchange and is a good overall indicator of Stockholmsbörsen's performance.

3.2. Closing Spreads

The spreads are maybe the most obvious cost of trading for the investors after the direct transaction costs. At any given time, in equity trading, an investor most likely has to pay more for a security than he could sell it back to the market for. Accordingly, in many prior studies it has been shown that spreads play a great role in the accurate price discovery and trading. Obviously, a large spread, say even 10%, makes a share less desirable than one with a smaller spread.

The closing spreads represent a snapshot value of the trading day. They cannot be used to study overall effective spreads. Even so, it is interesting to see if there are any signs of diminished closing spreads. If so, it would provide at least weak evidence of the market improvement; closing spreads would have diminished. However, due to the fact that they can provide us with only weak statistical evidence, I will introduce the results more as descriptive statistics in this part of the study than try to make any heavy conclusions based on them. I will, however, use the spread changes as determinants when dividing the data into smaller samples in the study. Table 1a presents the closing spreads for all shares, the 54 most liquid and 54 least liquid shares.

Table 1a

Spread Changes – Based on Pre-Event Liquidity

78-days average spreads before and after the event for the whole sample and for pre-event most and least liquid shares. T-tests are conducted to see if the daily average spread across the samples differ from each others. The spreads are percentage units calculated from the bid price. The differences represent the percentage decline from the previous value.

	All			Liquid			Illiquid		
	N = 108			N = 54			N = 54		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Average Spread	0.04665	0.01034	-77.82 %	0.02368	0.01222	-48.40 %	0.0704797	0.0083972	-88.09 %
St.Dev	0.00840	0.00550	0.00290	0.00767	0.00243	0.00524	0.01318	0.01038	0.00279
t-stat	30.4269	***		12.5910	***		32.6837	***	
Number of Negative	102 (94.44%)			50 (92.59%)			52 (96.30%)		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

The comparison between before and after spreads clearly shows us in figure 1a above, that the closing spreads have significantly diminished in the whole sample as well as in the sub-samples. In the whole sample it seems that the closing spreads are 77.82% smaller than before the LP-system was implemented and 94.44% of shares experienced a decline in their spreads. As predicted, the most illiquid shares experienced a larger change than the most liquid shares. On average, the liquid sub-sample shares almost cut half of their spreads from 2.37% to 1.22% calculated from the bid price. Illiquid sub-sample shares declined on average 88.09% from 7.05% to 0.84% of the bid price. The percentage of shares that experienced a decline in spreads is 92.59% and 96.30%, respectively. T-statistics are statistically highly significant for all sub-samples being 30.4269, 12.5910, 32.6837 for all shares, pre-event liquid and pre-event illiquid, respectively.

According to the results, the pre-event least liquid shares would have lower absolute closing spreads than the liquid ones, a finding that seems to be unreasonable. The reason why it is so amazing is simply the fact that the spreads before emergence of Liquidity Providers on the market were on average at 7.05%. However, to see if this would really be the case, further studies should be made with the accurate intraday-data on all trades. At least the results suggest that the number of shares experienced a drop in the spreads is larger in the illiquid shares sub-samples.

Table 1b

Spread Changes – Based on Spread Decline

78-days average spreads before and after the event for the whole sample and for small spread decline and the large spread decline groups. T-tests are conducted to see if the daily average spread across the samples differ from each others. The spreads are percentage units calculated from the bid price. The differences represent the percentage decline from the before value.

	All			Small Spread Change			Large Spread Change		
		N = 108			N = 54			N = 54	
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Average Spread	0.04665	0.01034	-77.82 %	0.01856	0.01348	-27.37 %	0.0747415	0.0072109	-90.35 %
St.Dev	0.00840	0.00550	0.00290	0.00497	0.00272	0.00224	0.01593	0.01037	0.00556
t-stat	30.4269	***		7.9210	***		31.3776	***	
Number of Negative	102 (94.44%)			48 (88.89%)			54 (100%)		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Table 1b presents the closing spreads before and after the event for all shares, and the divided sub-samples according to the reduction in size of their spreads. It clearly shows the development of the spreads in the whole sample. Even in the group with the smallest change the average spread has diminished 27.37%. The 54 largest spread reductions amount to, on average, a 90.35% decline from the pre-event levels. All the reductions are statistically highly significant having t-statistics of 7.9210 and 31.3776 for the smallest and largest spread decline groups, respectively.

At this point, it is evident that the closing spreads have diminished. But then again that is what Liquidity Providers are there for: to guarantee that they do. It must be kept in mind that the used spreads still are closing spreads and based on the study on them I can state only that the closing spreads have diminished. There is no meaningful way to assure that real spreads have declined throughout the sample days. Judging by the closing spreads, it seems to be the case that the least liquid shares in both countries have improved their liquidity a great bit, as their spreads used to be on average around 7% of the bid price before this new system was implemented.

One more word of warning arises from the minimum requirements of Liquidity Providing. According to these requirements, the Liquidity Provider has to guarantee at minimum 4 trading lots at 85% of the time of the continuous trading as well as in the applicable opening and closing auctions. A straightforward conclusion is that even if there were Liquidity Providers' quotes on the market almost all of the time, it does not mean that there are enough of these quotes to meet the market demand. In other words, effective spreads in general may be much larger than the ones we have witnessed here. Only a study with accurate trading data would give us an answer.

3.3. Data Samples

As the target of the study is to study the effects of diminished spreads on the market, the first thing to do is to establish a link between improved liquidity and diminished spreads. Of course, at this point, we already know that the spreads have diminished, and accordingly, any other changes would be at least partly a result of this reduction. However, in order to get more meaningful results to support the theory I find it adequate to continue the study also from the spreads point of view.

The theory that I introduced in the first chapter, suggests that the liquidity of underlying shares improves as spreads decline. In other words, the declining spreads would lead into increased trading. This improved liquidity should be seen as improved market quality and finally all the improvements in turn should be something that investors put value on. Therefore, I have initially divided the sample into three sub-samples: *1) Percentage change in spread, 2) pre- event liquidity, and 3) Magnitude of increase in trading.* Of course, I will also introduce the results for the whole sample of shares throughout the study.

First, I have divided all shares into two, based on the decline in the closing spreads. This sampling is done in order to try to establish a link between the decreased spreads and any other market reactions. At least, the very basis of the liquidity providing is to try to affect the market by lowering spreads. Thus, any other market reaction should be as a result of that. Many prior studies have shown results that indicate that decreases in spreads cause positive market reactions.

Second, shares are divided into sub-samples based on the presumption that the most liquid shares are anticipated to have less of an impact from liquidity providing. The least traded shares in general are expected to be more subject to infrequent trading, larger spreads, and even asymmetric information. Therefore, I can expect that they are also much further away from the efficient market hypothesis. The most traded shares however have been frequently traded and their spreads have been under the Liquidity Providers' guaranteed values and thus closer to the efficient market hypothesis. The data is divided in two by their euro trading volume median in all sub-samples.

Third, the shares are divided into sub-samples based on their trading volume improvement. That sampling is done to capture the effect of improved liquidity to some extent. I believe, that by doing so, I can best capture the effects of improved liquidity on the market without taking a stand as to what has caused the improvement and thus more closely to link it to the theory of liquidity. That should give us a better view of the market behavior in the case of improving liquidity. Of course, it's also true that shares that have experienced the largest increase in trading volumes have benefited the most in terms of liquidity. Therefore, any other market reaction in that group should reflect possible benefits of the Liquidity Providers at best. On the other hand, shares that have experienced the smallest increase in trading volumes should at least in theory have less, if any, other market reactions. That would be the case with the most liquid shares that in a way are already trading at full speed, i.e. there is natural equilibrium between the demand and supply. Nevertheless, as the spreads go down, this equilibrium could, at least in theory, move to a new level.

The data division into smaller sub-samples is very limited as the sample size is relatively small to begin with. I however, believe that the bipartition of the samples based on these three aspects is sufficient enough to answer to the research problem from various aspects. In table 2 below, I present the overlap of the selected sub-samples.

Table 2

Sample Overlap

The percentage figure shows how many of the same shares occur in two different samples. Categories are *Spread* change, pre-event *Liquidity* and improvement in *Trading* volumes.

	Spread	Liquidity	Trading
Spread	100 %	71.43 %	51.85 %
Liquidity	71.43 %	100 %	57.41 %
Trading	51.85 %	57.41 %	100 %

Table 2 shows us that the selected samples do not overlap very heavily in any of the combinations. Most overlapping is, not surprisingly, with the Liquidity improvement and Spread decline groups where the percentage is 71.43%. However, table 2 also shows us that the largest decline in spreads do not necessarily lead to the largest increase in trading. Neither the large decline in spreads nor the pre-event illiquidity correlate very much with the sample of the shares that experienced the largest increase in their trading volumes. Therefore, I find it

justifiable to use the selected samples in order to be able to answer the research questions in broad terms.

In the rest of my paper I will concentrate on market reaction and concrete evidence of improved liquidity and intensified market efficiency. In the next section I introduce my hypotheses more closely and go through the methods I will be using. After that, I will present the empirical evidence based on the models I have built for this study. In the Final chapter I go through what we have learned and discuss issues arising from my findings.

4. HYPOTHESES AND EMPIRICAL METHODOLOGY

In this chapter I explain the methods I am going to use. My main hypothesis is that the liquidity providing system improves market quality and thus increases trading. I also predict that investors value this improvement. My hypotheses are as follows:

1. The emergence of Liquidity Providers will lead to a decline in the observed spreads.
2. These lowered spreads will promote liquidity and thus increase trading volumes.
3. The improved liquidity, caused by lowered spreads, will enhance market efficiency.
4. The improvement in liquidity and market efficiency is valued by investors.

To test my hypotheses I will conduct several tests concerning the issues at hand. The tests I have chosen are all widely used in academic literature. In the following subsections I introduce the methodology.

The natural starting point for studying the effects of liquidity providing is to study whether the liquidity has improved. To test this, I look into trading volumes and market depth. Any other possible market reactions should be a result of improved liquidity. In addition, as I presented in Section 3.3, the improved liquidity is one basis for data sampling. Cumulative Abnormal Returns are calculated next to capture any abnormal price rise due to Liquidity Providers. Then I will look into the market quality.

To test the statistical significance of my results, I will conduct common t-tests for volumes and spreads. It should however be noted that a t-tests' ability to create statistically satisfying results with small samples is regarded to be inferior to Wilcoxon's signed rank test. Therefore, I also present the Wilcoxon z-values for paired samples throughout this paper.

4.1. Liquidity

To study if there is a rise in liquidity I have employed two different models. The theory behind the models is that other things being equal, the trading volume or trading frequency of a given security is an increasing function of its liquidity (see Mendelson, 1982, 1985; Amihud and Mendelson, 1986). Thus, an increase in trading volume of a share after the imputation of a new system reflects an increase in its liquidity.

First, I will use a descriptive *Excess Volumes*-method to graphically show the change in the past average daily monetarily adjusted volumes. The results can and will be tested for statistical significance and then, I study whether there is a difference in the market depths before and after.

4.1.1. Excess Volumes

One of the main targets of Liquidity providing is to guarantee the possibility of trading for any given share at any given time. A Liquidity Provider guarantees that there are both bid and ask quotes on the market most of the trading time. Therefore, an ex-post increase in trading volumes is a very clear indicator of improved liquidity.

The *Excess Volumes*-model is quite similar to the *CAR*-model to the extent that it is based on the ex-ante - 'normal' situation. By making this normality assumption it is fairly easy to study any deviation from it. The *Excess Volumes* - method that I use is based on the assumption that the average daily volume across the sample before the event is one. In other words, average daily euro volumes before the event day across the samples are normalized with the average euro volume in the pre-event window. The same pre-event average is used after the event also. If there are no changes in the trading volumes; the post-event *Excess Volumes* should be close to one. My hypothesis is that when spreads decline, the market's frictions decline, which in turn makes the shares more desirable and thus liquid. There should thus be a clear jump in the excess volumes at the event date and the trading volumes should settle to a new level.

I will use euro volumes in this study in order to exclude any share price changes from the study. This is based on the assumption that there is a fixed amount of money in the market and it is allocated between all shares on the market. Any increase in the euro amount trading on a particular share represents an increase in its demand. Absolute units would tell us nothing about the actual demand as it can at any given time deviate heavily depending on the prevailing share price. Accordingly, I find it appropriate to study the absolute trading volumes instead of market relative volumes[8]. After all, my main interest is whether the trading volumes of the underlying shares improved. Another justification is the fact that the shares engaging in the liquidity providing system are well dispersed over about three years and there is little possibility, if any, that the results could stem from aggregate time trend changes in the market places.

The *Excess Volumes*-method is an efficient way to graphically show any change in the trading pattern. For the graph I have to first calculate the daily excess volumes across the samples. The pre-event average daily euro volume is calculated for each share and for the whole samples using a 65 day window before the event from T -74 to T -10. Consequently, the relation between the daily euro volume and the ex-ante average is calculated for trade dates T -40 to T +40. The formula I will use is as follows:

$$ExEurVol_t = \frac{\sum_{j=1}^{N} (EurVol)_{jt}}{Average\,(EurVol)_{before}}, \qquad (1)$$

where $ExEurVol_t$ is the daily excess euro trading volume for the sample at time t, $(EurVol)_{jt}$ is euro volume of stock j at time t, Average $(EurVol)_{before}$ is the 65 day sample daily euro volume average for the period from T -74 to T -10 before the event. The summation is across the sample shares at time t. Any post-event deviation from one will mean exception from pre-event average trading volume level. In this study I will show results in a 10 day *Excess Volumes* moving average graph to show the difference between ex-ante and ex-post volumes.

[8] Amihud and Mendelson (1997) use relative trading volumes (i.e. percentage of the market place's total trading volumes) to study the change in the liquidity. Another commonly used method is to use the turnover ratio which is the proportion of the total number of shares on the market that are traded at any given time.

To statistically test whether the trading volumes have increased, I conduct a common t-test and Wilcoxon signed rank test. The t-tests are done on the ex-ante and ex-post daily average excessive volumes. The proper t-test for the sample averages will be a two sample t-test assuming unequal variances. Wilcoxon z-values are calculated for the paired sample of shares to study whether the shares have experienced an increase in trading volumes on an individual basis.

4.1.2. Liquidity Ratio

The liquidity ratio (LR), also called Amivest measure of liquidity, measures the trading volume associated with a unit change in the stock price. The measure represents the euro volume required to move a share price 1% up or down, that is what euro volume of trading is necessary to effect a 1% price change. A higher LR implies greater market liquidity or depth. The liquidity ratio is defined as

$$LR_j = \sum_t V_{jt} \Big/ \sum_t \left| R_{jt} \right|, \qquad (2)$$

where, V_{jt} and R_{jt} are, respectively the volume and return on stock j on day t, and the summation is over the days in the estimation period (see Cooper et al., 1985; Khan and Baker, 1993). Estimation period in use is from T -49 to T -5 for the period before and from T +5 to T +49 for the period after the event. The relative change in the liquidity ratio (LR) for stock j is defined by

$$DLR_j = \log (LR_{j,\,after} / LR_{j,\,before}), \qquad (3)$$

where the subscripts are as defined above. To see whether there has been any significant change in the LR a t-test for paired sample and a Wilcoxon signed rank test is employed.

4.2. Efficiency

One of the targets of the LP-system is to improve efficiency. In theory, any improvement closer to the efficient market hypothesis should improve market efficiency. Smaller spreads at least give investors a possibility to react quicker, with lower costs, and with more accuracy to any new information in the market.

Amihud and Mendelson (1991b) (see also Amihud et al., 1997) introduce the Relative Return Dispersion, based on the variance of returns across securities, as a descriptive measure of the efficiency of a trading mechanism. The RRD should decrease as market frictions decline. The RRD-model prediction is based on the premise that a market model should become a more descriptive model of an exchange's securities when the exchange's trading costs and other frictions are lower. Accordingly, the market model is estimated in the pre and post event to find out if the estimations are better in the latter.

With very illiquid shares there may be several trading days between the days that these shares actually are part of trading. The share price development between two consecutive trades can be of large size due to the elapsed time period between the trades. In addition, large spreads have a tendency to make market model error terms larger. It is easy to understand that due to this, the market model error terms, which in this case are the base of RRD, are large and any increase in trading and decrease in spreads would have a lowering effect on these error terms.

With the most liquid shares the effect may not of large significance or extent. These shares are already trading on a daily basis and their spreads are at a lower level than the Liquidity Providers minimum requirements are. Accordingly, I am expecting to observe a smaller, if any, change in RRDs with liquid shares.

The RRD-model statistic is calculated for time-t as follows:

$$RRD_t = \sum_j \varepsilon_{jt}^2 \Big/ n \quad , \tag{4}$$

where RRD_t is relative return dispersion for the entire sample (sub-samples) of securities at time t; ε^2_{jt} is the squared market model (5) residual for security j at time t; and n is the number of securities at sample time t. The summation is across the sample shares for time t. RRD_t's are estimated for a 90 day period before and after the event date for all samples. I will use a 19-day window around the event day to exclude any abnormal behavior from the sample.

To statistically show the difference between the pre-event and post-event situation, I will use t-tests assuming unequal variances. I present the average sample RRDs for all the samples as well as the change in them. I will also present Wilcoxon signed rank z-values for paired sample based on the change in individual shares' RRDs for the pre and post event periods.

4.3. Cumulative Abnormal Returns

A very interesting and important issue to study is whether there are positive returns related to shares in the sample around the LP implementation date. If there is any value in improved liquidity, the imputation of the LP systems would affect the share price and result in abnormal returns. To study any abnormal gain in share prices around the event day I have employed a CAR-model around the event date to see if there are any permanent price changes.

The method frequently used to investigate abnormal performance when there is incomplete prior information about the event when it occurs is the 'cumulative average residual' or 'cumulative abnormal returns' (CAR) technique introduced by Fama, Fisher, Jensen and Roll (1969). The methodology is very simple. It is based on the common market model and has been widely used (see e.g. Amihud et al., 1997 or Brown and Warner, 1980). The model should reveal any price changes around the event day. My hypothesis is that liquidity is one component of the share price and thus investors should put some value on its improvement.

The rationale behind the model is that the market model would on average predict the share price correctly based on the overall market movement. Accordingly, in the normal environment without any external shocks, daily returns would be evenly distributed around the market model predictions. Observation deviations, error terms, from the model's prediction are assumed to be normally distributed with a mean of zero. In other words, the summation of subsequent daily returns over time would result in zero and there would not be any abnormal returns. If there are abnormal returns then this summation is expected to be positive and increasing over time until the share price reaches its new level (or vice versa). After the new price level has been reached, the summation of error terms over time would once again be zero.

I estimate the market model regressions

$$R_{jt} = \alpha_j + \beta_j RM_t + \varepsilon_{jt}, \qquad (5)$$

where R_{jt} is the logarithmic return on stock j on day t and RM_t is the daily logarithmic return on the market related to the share in hand (that is logarithmic daily total return on the chosen

market indices). α_j and β_j are the constants and the coefficients, respectively, and ε_{jt} are the residuals. The market model is estimated over days T – 95 to T – 6.

I then calculate the abnormal returns for the sample

$$AR_{jt} = R_{jt} - (\alpha_j + \beta_j RM_t), \qquad (6)$$

for each share j and each day t in the event window (days T – 5 through T + 40) where the parameters α and β have been estimated by the market model (5) and R_{jt} is the actual logarithmic return for share n at time t. The cumulative abnormal returns for the whole sample are defined as

$$CAR_{sample} = \sum_{t=-5}^{40} \left(\frac{\sum_{j=1}^{N} AR_{jt}}{N} \right), \qquad (7)$$

where CAR_{Sample} is sample average CAR for the days T - 5 to T + 40. AR_j is the abnormal return for share j on day t and summation is performed over the whole sample at time t. N is number of sample shares. The daily development of CAR_{Sample} from T – 5 to T + 40 is presented in graphs for all sub-samples. The clear evidence of increased prices would be a rise in CAR_{Sample} after the event day, T = 0. The graphs will cover an event window from T -5 to T +40.

The abnormal returns will then be tested for significance. For this I will conduct a common t-test with the null-hypothesis that the event-window abnormal returns are zero. If the nuul-hypothesis is rejected then CARs exist. The test will be done on the 15-days cumulative abnormal returns.

5. EMPIRICAL RESULTS

In the second chapter I introduced some of the most obvious handicaps for the overall market stemming from bad liquidity and large spreads. The reasons varied from holding costs to asymmetric information. In any case, I found it logically coherent to claim that the Liquidity Providers can affect these downsides, at least in the worst case scenario. By lowering spreads and guaranteeing that trades can take place every day, they at least make the shares more desirable for the investors.

In the literature review chapter I introduced various theories surrounding liquidity. The general tendency was that market microstructure improvements would have a positive effect on both trading and the share values of the underlying shares. The results in those studies are very much the same as I am expecting to obtain. However, where Bacidore (1996) and Ahn at al. (1995) failed to find an increase in trading volumes when the spreads decline and accordingly theoretically liquidity improved, I am waiting to get clear signs of increased volumes at least in the group of the most illiquid shares.

In this chapter I will go through the findings regarding the LP-system. The starting point is liquidity. The ultimate justification for the presence of the liquidity provides' is the promise they will enhance market efficiency. As I have presented earlier in this study, the method of doing so is to guarantee that during most of the normal trading time, there exists a fairly priced bid-ask spread. The bid-ask spread has a maximum range it has to lie on in order to reduce the indirect costs stemming from spreads. I start by creating a link between diminished spreads and improved liquidity in trading.

5.1. Liquidity

The main goal of a liquidity providing system is to improve liquidity and efficiency. That is done by guaranteeing the quotes on the market on most of the trading time. In addition, the bid and ask quotes are required to be in a certain range from each others so that the costs caused by the spreads would decline. In chapter 3.2 I have already shown that the spreads have declined. In this chapter I will study whether those declined spreads have lead to the desired effect, i.e. an increase in trading?

To test the change in liquidity I will employ two different kinds of models. The first one, called *Excess Returns* – model, is a graphical way to show if there is a change in the average trading volumes. Data behind the graphs can be tested for statistical significance. The second model measures market depth using liquidity ratios. It measures what amount of trading has to take place in order for it to have an effect on the share price.

According to my hypothesis there should be clear signs of increased trading activity as well as deepened market depth. Even if some of the prior studies at least partly have failed to find results of increased trading volumes and market depth, the prior similar studies have reported solid clear evidence. Trading frequencies and the spreads have been at very undesirable levels with the most shares under the investigation. The new system does not only decrease their spreads but also enables the trading.

5.1.1. Excess Volumes

An excess volumes graph is a way to show any movements in average daily euro volumes. The method is based on the average daily pre-event trading volume across the sample shares. The pre-event daily trading volumes are normalized with the average daily pre-event trading volume so that in the graph they are around one. After the event there should be a jump in the graph if the trading volumes have changed. In addition, the trading volumes should keep their new level to show a permanent change. I will present the 10-day moving excess trading volume average graphs to make the graphs more clear instead of scatter graph..

Figure 3a

Excess Volumes Graph – Based on Spread Improvement

The graph shows the 10-day moving trading volume average excess volumes from the event window -30 to +40. Excess volumes are calculated as the ratio of daily euro volume and 65 day average volume per euro (days -74 to -10). Graph value over one indicates that the daily average volume across the sample is more than average volume before the imputation of the LP system. The line in the picture is a 10-day moving average

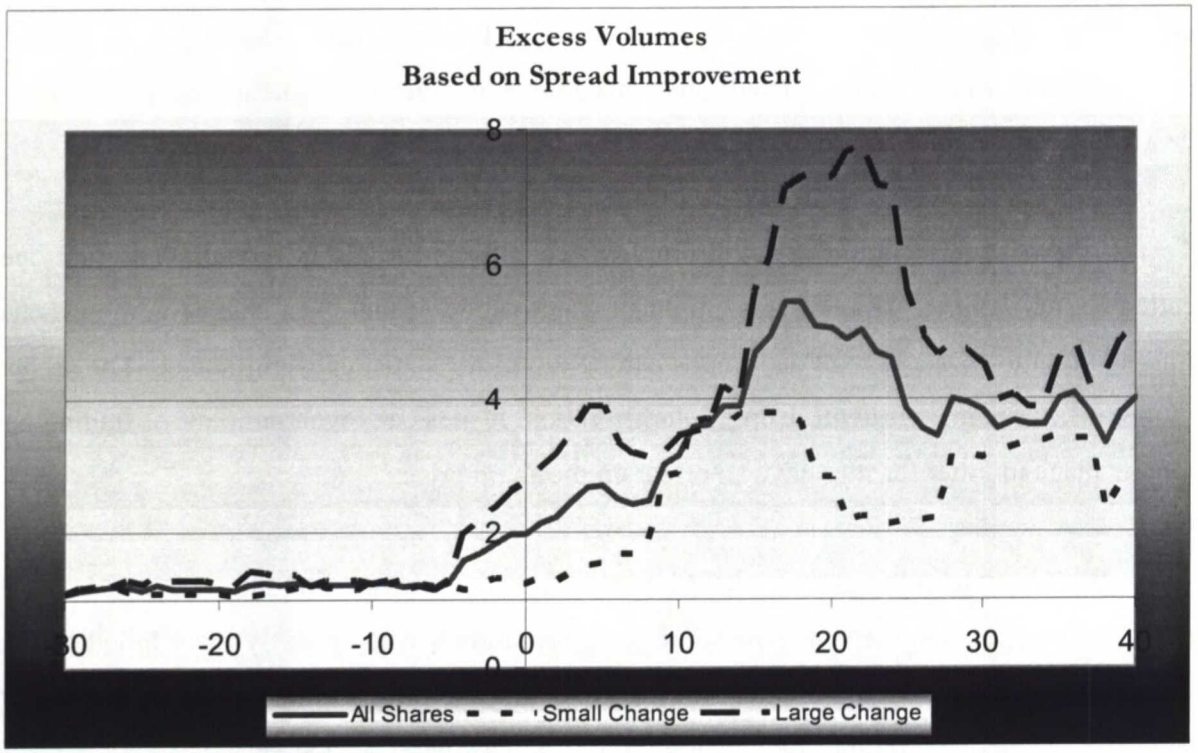


Table 3a

Excess Trading Volumes Results – Based on Spread Improvement

The table presents average excess trading volumes in euros before and after the event. Average volume before is calculated from 65 days period starting from T-74 and ending to -10. After period average is calculated also form 65 days period starting from T+10 and ending to T+74. A two sample t-test assuming unequal variances is conducted to daily sample averages before and after the event. Wilcoxon z-values are calculated for the paired sample of shares before and after.

	All			Small Spread Change			Large Spread Change		
		N = 108			N = 54			N = 54	
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Excessive Volume	1.00000	4.95657	3.95657	1.00000	2.81661	1.81661	1.00000	7.14633	6.14633
St.Dev	0.57820	1.99319	1.41499	0.32973	1.94394	1.61421	0.50261	7.84815	7.34554
t-stat	8.0514	***		7.4281	***		6.3011	***	
Number of positive	91	(84.26%)		47	(87.04%)		44	(81.48%)	
Wilcoxon z	7.4636	***		5.6311	***		4.8992	***	

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Figure 3a above presents the Excess Volumes graph for three spread change based sub-samples.

The spread changes seem to influence liquidity. The picture shows a clear increase in the trading volumes in all samples. The all shares graph (solid line) clearly rises to a new level after the emergence of Liquidity Providers. In the graph it seems that the new level for the whole sample would be around 4 indicating 300% increase in trading volumes! As can be seen in the graph, the average trading volume graphs remain at about the level of one until a couple of days before the event, just as it should, as the pre-event trading volumes are divided with their average.

In table 3a above shows the statistics for these three samples. The results are very convincing. The table presents the 65-days pre- and post-event Excess Volumes averages. All shares' trading volumes double just before the event and continue rising rapidly. 91 of all 109 shares, i.e. 84.26%, experienced improvement in their trading volumes. The post-event 65-days average excess volume is around 4.96 indicating increase of 396%. T-statistic for that rise is 8.0514 and corresponding Wilcoxon z-value for paired sample increases is 7.4636 meaning that the results are statistically significant at the 0.001% level.

The 10-day moving average line for the shares that have experienced the largest spread reduction clearly reaches a higher level than the other two sub-samples. The rate of rise is also much higher around the event in the case of a large spread improvement. This supports the theory that claims the spread to be a major determinant of liquidity. However, after day 30, the difference between the groups experiencing small spread versus large spread changes is not very large.

The test results for those other two sub-samples are convincing as well. As can be seen in the graph, the two groups that are separated based on spread improvement have experienced increases in trading volumes. The large spread improvement group has reached a 7.14633 times higher level and the least improved shares 2.81661 times higher level than before the event than before the LP-system was introduced to the market. 81.48% of the small spread change group's share experienced increases in trading volumes and the number was even larger for the small spread change group, i.e. 87.04%. T-statistics for these two samples are 7.4281 for small spread change group and 6.3011 for large spread change group, which

indicates statistically highly significance for both sub-samples. In addition, the Wilcoxon z-value for paired sample of increase in trading volumes are significant for both groups being 5.6311 and 4.8992 for large and small spread change groups respectively.

A quite interesting fact is that the trading volumes start to rise before the event day. It is often reported in academic literature that the cumulative abnormal returns start to rise already before the event day because of information leakage. That is in the case that there are agents on the market that speculate on the effects of the event.

Here, the all shares and the largest spread change group's graphs start to rise already before the event. That may be a sign of information leakage indeed but there may also be another possible explanation. It may be the case that (at least partly) the reason for the pre-event increase could be the transactions made by Liquidity Providers. After all they have to carry at least some kind of inventory in order to meet the market requirements. Anand et al. (2005) also found that trading activity increased following the contracting, suggesting that Liquidity Providers were actively engaged in trading with public customers. Similarly, there is a jump in the graph around day 20. It is very hard to come up with an explanation for this but it could be an indicator of changes in ownership structure. To find out if that is the case a study with more accurate agent data should be made in order to reveal the activities of Liquidity Providers.

Nevertheless, the 'normal' trading reaches a new level and the test results are statistically significant. Furthermore, there is an observable link between the magnitude of the spread decline and the increase in trading volumes even if the percentage number of gainers is larger in the large spread change group than in the other. The results are very convincing regardless of the fact that they are not market adjusted. In addition, but not surprisingly, the results are very similar to those earlier studies on the effects of Liquidity Providers.

Figure 3b

Excess Volumes Graph – Based on Pre-Event Liquidity

The graph shows 10-day moving trading volume average excess volumes from the event window -30 to +40. Excess volumes are calculated as the ratio of daily euro volume and 65 day average volume per euro (days -74 to -10). Graph value over one indicates that the daily average volume across the sample is more than average volume before the imputation of the LP system. The line in the picture is a 10-day moving average.

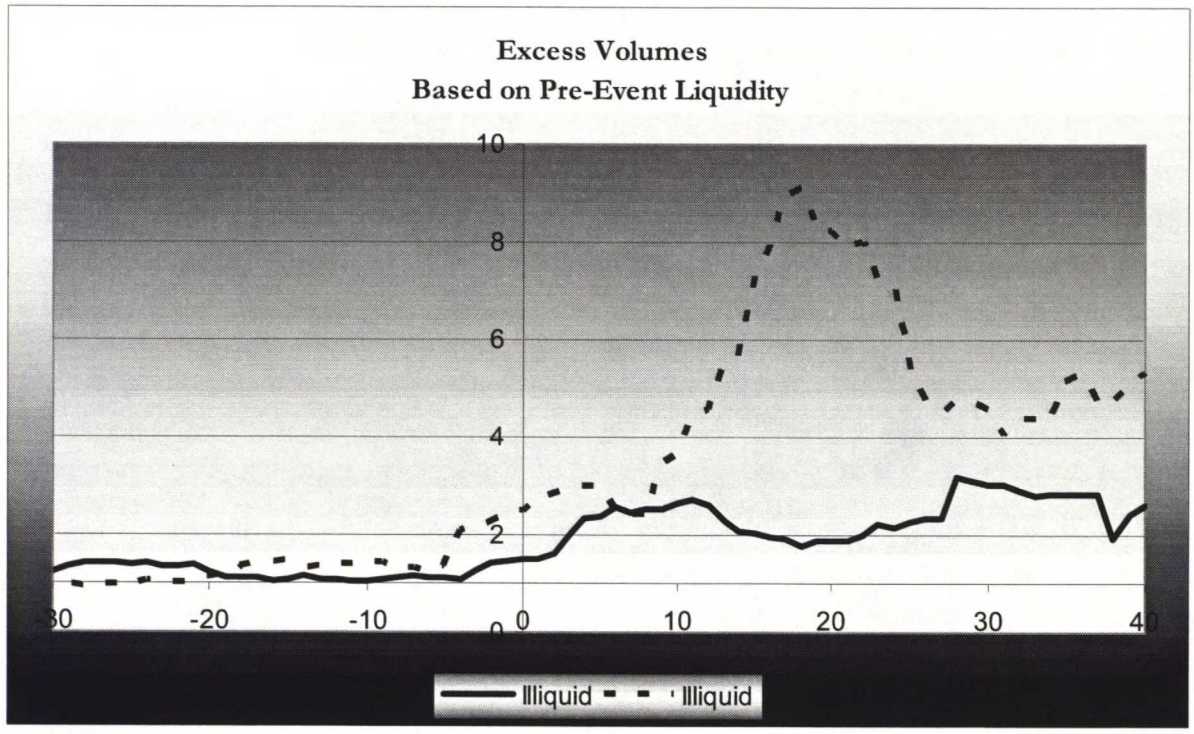


Table 3b

Excess Trading Volumes Results – Based on Pre-Event Liquidity

Average excess trading volumes in euros before and after the event are presented in the table. Average volume before is calculated from 65 days period starting from T-74 and ending to -10. After period average is calculated also form 65 days period starting from T+10 and ending to T+74. A two sample t-test assuming unequal variances is conducted to daily sample averages before and after the event. Wilcoxon z-values are calculated for the paired sample of shares before and after.

	All			Liquid			Illiquid		
		N = 108			N = 54			N = 54	
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Excessive Volume	1.00000	4.95657	3.95657	1.00000	2.49375	1.49375	1.00000	7.46919	6.46919
St.Dev	0.57820	1.99319	1.41499	0.38694	1.43115	1.04421	0.49749	7.85254	7.35505
t-stat	8.0514 ***			8.1233 ***			6.6287 ***		
Number of positive	91 (84.26%)			45 (83.33%)			46 (85.19%)		
Wilcoxon z	7.4629 ***			5.1855 ***			5.4094 ***		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Figure 3b and table 3b above present the results for the two sub-samples based on pre-event liquidity measured as trading volumes. The results are along the lines with what was anticipated. Figure 3b clearly shows that there is a rise in trading levels in both the pre-event illiquid and liquid shares sub-samples. Here again the trading volumes start to rise a couple of days before the event day and seem to be settling in their new level around the day T+30.

As anticipated, the rise in trading volumes is larger with the most illiquid shares. In that sub-sample the post-event 65-days excess volume is on average around 7.47 indicating roughly a 650% rise in average trading volumes. From the sample of 54 shares, 85.19%, i.e. 46 shares, experienced increases in their trading volumes. The results are statistically highly significant in both measurements. T-statistic in this sub-sample is 6.6287 and Wilcoxon z-value for the paired sample for improvement is 5.4094.

With the most liquid shares, the rise in trading volumes is a bit more modest but nevertheless obvious. Even in this sub-sample 83.33% (45 out of 54) of shares were trading on average at a 2.49375 times higher volume than before the event. T-statistics for this improvement is 8.1233 and the Wilcoxon z-value is 5.1855. Both are statistically highly significant.

The results for these two groups are close to the ones with spread decline based sampling. The originally illiquid shares seem to gain as much as the shares whose spreads declined the most in the terms of excessive volumes. Accordingly, originally most liquid shares and the shares whose spreads declined the least show a much more modest change in their trading volumes. That is not surprising due to the fact that the small spread change and liquid shares samples overlap about 78%. However, the division based on pre-event liquidity achieves more deviation between the two groups indicating that the magnitude of spread decline may not be the dominant player in the liquidity improvement. This is impossible to determine without further studies. One thing is for sure. The spreads have role in liquidity.

Figure 3c

Excess Volumes Graph – Based on Improvement in Trading Volumes

The graph shows 10-day moving trading volume average excess volumes from the event window -40 to +40. Excess volumes are calculated as the ratio of daily euro volume and 65 day average volume per euro (days -74 to -10). Graph value over one indicates that the daily average volume across the sample is more than average volume before the imputation of the LP system. The line in the picture is a 10-day moving average

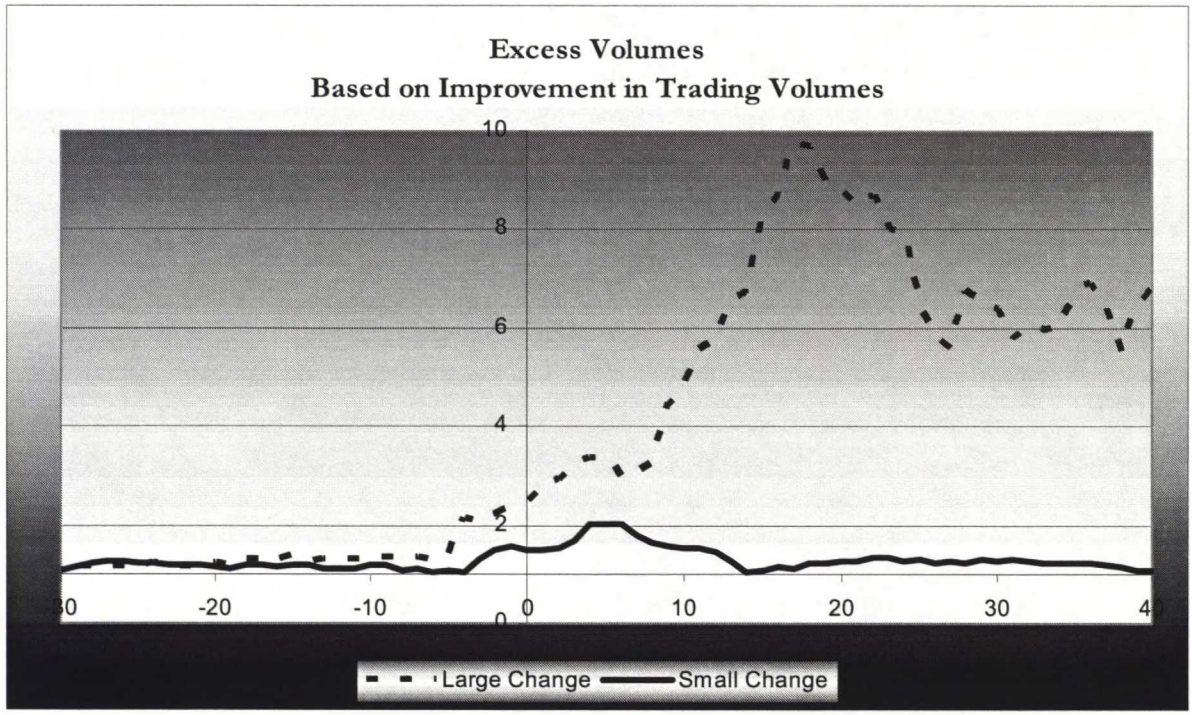


Table 3c

Excess Trading Volumes Results – Based on Improvement in Trading Volumes

In the table are presented average excessive trading volumes in euros before and after the event. Average volume before is calculated from 65 days period starting from T-74 and ending to -10. After period average is calculated also form 65 days period starting from T+10 and ending to T+74. A two sample t-test assuming unequal variances is conducted to daily sample averages before and after the event. Wilcoxon z-values are calculated for the paired sample of shares before and after.

	All			Small Change			Large Change		
		N = 108			N = 54			N = 54	
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Excessive Volume	1.00000	4.95657	3.95657	1.00000	1.24849	0.24849	1.00000	8.71445	7.71445
St.Dev	0.57820	1.99319	1.41499	0.45955	0.34827	-0.11128	0.37368	8.01117	7.63750
t-stat	8.05137	***		3.47445	***		7.75521	***	
Number of positive	91	(84.26%)		37	(68.52%)		54	(100%)	
Wilcoxon z	7.4636	***		2.2688	*		6.3931	***	

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Figure 3c contains the 10-day excess volume moving average graph based on the improvement in trading and table 3c contains the statistics. Figure 3c clearly shows that the least benefited half of the sample has been able to only slightly improve their liquidity in terms of trading volume. Nevertheless, the increase seems to be statistically significant.

The most gained half of the shares' post-event 65-days average excess volume is at 8.71445 time higher level than before the event. Naturally in this part of the sample there are only shares that experienced increase in trading volumes. Without saying, the results for this sample are statistically important. The other part of the sample experienced only around 24.85% rise in their trading volumes. Nevertheless it is statistically highly significant even if the statistics here are weaker than with any other sub-sample before.

The group with the least improvement in the trading volumes has increased in trading volumes only slightly. In the figure the trading pattern seems to jump a little before the event date. That would furthermore convince me of the fact that all the jumps before the event day in the graphs would be the trades made by Liquidity Providers themselves acquiring necessary inventory for the future trades. Of course it cannot be proven here, but if the case is so it would influence the normal market behavior around the event date. For instance, the following tests for the abnormal returns may be a result from the market makers acquisitions.

In this section I have tried to link the decline in spreads to an improvement in trading and thus in liquidity. First, I presented the results where I found a connection between the spread size reduction and the trading volume increase. According to these, it is evident that the spreads and the liquidity go hand in hand. Shares that experienced a larger drop in the spread levels also experienced a larger rise in their trading volumes. That in turn is convincing proof that the presence of Liquidity Providers on the market is justified. At the same time it gives us evidence of inefficient markets as the evidence suggests that there can be an external system that can boost activity.

Second, I showed that those shares that were originally least liquid gained relatively more than their more liquid counterparts. The results with the most liquid shares were close to the one with the least spread change. The reason behind that behavior is partly due to the fact that the spread change groups and pre-event liquidity based groups overlap by 78%. Nevertheless, the improvement is clear in both sub-samples. Therefore, it is fair to say that Liquidity

Providers in general are capable to increase trading regardless of the liquidity of the share and that improvement is larger with originally illiquid share.

I also found out that the increase in trading volumes started commonly already before the imputation of the new system. That may be in part due to the fact that in order for the Liquidity Providers to be able to guarantee the trades, they have to carry at least a little inventory. If so, the jump in the trading graphs before the event day could be as a result of the trades made by Liquidity Providers themselves. In addition, there was a jump in the graphs around day T+20. The reason could be that there is a change in ownership structure. After all, the institutional investors would now be more interested in these shares as they meet the requirements that institutional investors set for shares they want to keep in their portfolios.

The characteristic of Liquidity Providers would suggest that Liquidity Providers themselves cause trading volume when acting on the market. However, with the data at hand the impact of the Liquidity Providers' trades on the trading volume remains unsolved. Nevertheless, no matter who is trading the shares, the results here suggest that the trading volumes have increased substantially in all sub-samples.

5.1.2. Liquidity Ratio

In this chapter I Will look into market depth. Market Depth is the size of an order needed to move the market a given amount. If the market is deep, a large order is needed to change the price. To measure that I introduced a liquidity ratio, the so-called Amivest measure, in the section 3.4.3. The measure tells us how big euro volume of trading needs to be in order to cause a 1% movement of the share price either up or down. A higher LR implies improved liquidity and thus, larger market depth. I will introduce the results for all three samples staring from the ones with spread changes.

My hypothesis is that market depth gets deeper as the shares acquire a Liquidity Provider to help their trading. Many aspects support that. The very basics of economics suggest the price equilibrium of any given share is where the supply and demand meets. If there is vast amounts both demand and supply in the equilibrium no small addition on either side will have power to move the equilibrium. Before the existence of Liquidity Providers the trading of many of the sample shares was really infrequent and small. Therefore, I would suggest that the ability to influence market price would have been greater before the trading volumes went up. As we have seen so far the trading volumes really have increased especially with the most illiquid shares.

Table 4a

Relative Changes in Liquidity Ratios – Based on Spread Improvement.

In the table are shown relative average changes in the liquidity ratios (formulas 2 and 3 above) between before and after the event. Ratios are calculated from -49 T to -5 T for before sample and from +5 T to +49 T for after sample and DLRs are derived from them. Positive DLR implies greater market liquidity or depth. T-test and Wilcoxon signed rank test for DLRs is conducted with the null hypothesis that the DLR is zero.

	All		Small Spread Change		Large Spread Change	
	N = 108		N = 54		N = 54	
Average DLR	0.71742		0.65293		0.78191	
St.Dev	0.98450		0.84322		1.11232	
Number of positive	88	(81.48%)	42	(77.78%)	46	(85.19%)
t-stat	5.3550	***	5.6902	***	5.1656	***
Wilcoxon z	6.7027	***	4.7636	***	4.7033	***

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

In the table 4a above are the results for the sample shares divided into sub-samples based on their spread decline. Starting from the whole sample the DLR[9] has increased in 88 out of 108 of the sample shares. Average DLR for the whole sample is 0.7174 implicating that all shares now on average require higher euro volume to move share prices up or down 1% than it was the case before the event. The t-statistic for that sample is 5.3550 being statistically significant at 0.1% level. The Wilcoxon signed rank z-value for the shares with the positive DLR is highly significant being 6.72027.

Not surprisingly, the sample with the shares that experienced the largest decline in the spreads have also in here taken the most out of the Liquidity Providers' services. As I showed already above these shares experienced also a large increase trading volumes. In that sample the average DLR is 0.78191. That figure is not terribly higher than it was above with all shares. 85.19% of the shares in this class have increased in the terms of liquidity ratio. T-statistic for DLR is 5.1656 and Wilcoxon z-value for the DLRs not being zero 4.7033.

The small spread change sub-sample shows results of deepened market depth as well. To be more precise the results do not alter a great deal from the ones that we have seen so far in the other two samples. The average DLR in this sample is 0.65293 while 77.78% of all shares have positive DLR. The t-statistic for the sample average DLR is 5.6902 and the Wilcoxon z-value 4.7636.

To sum up, the size of spread improvement in spreads alone does not play a crucial role in deepening market depth in this study. The results across the sub-samples are really close to each others. Even so, there can been seen some relations between the spreads and the market depth but I would suspect that the common factor is more in the increased trading volumes that does not correlate with spread movements 100%. In the table 4b below are the statistics for the pre-event liquidity based sub-samples.

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[9] DLR is the relative change in the liquidity ratio (LR)

Table 4b

Relative Changes in Liquidity Ratios – Based on Pre-Event Liquidity

In the table are shown relative average changes in the liquidity ratios (formulas 2 and 3 above) between before and after the event. Ratios are calculated from -49 T to -5 T for before sample and from +5 T to +49 T for after sample and DLRs are derived from them. Positive DLR implies greater market liquidity or depth. T-test and Wilcoxon signed rank test for DLRs is conducted with the null hypothesis that the DLR is zero.

	All		Liquid		Illiquid	
	N = 108		N = 54		N = 54	
Average DLR	0.71742		0.54612		0.88872	
St.Dev	0.98450		0.88386		1.05629	
Number of positive	88	(81.48%)	41	(75.93%)	47	(87.04%)
t-stat	5.3550	**	4.5405	***	6.1827	***
Wilcoxon z	6.7027	***	4.1264	***	5.2113	***

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

From the table 4b we can straight away see that the results are as anticipated. Initially more liquid shares have gained less than the initially less liquid ones. The average DLR for liquid sub-sample shares is 0.5461 with 75.93% of them having it positive. T-statistic for the sample is 4.5405 and Wilcoxon z-value for the DLRs is 4.1264. Results are statistically satisfying.

The illiquid share sub-sample shares have deepened their market depth the most. Average DLR in this sub-sample is as high as 0.8887 with 87.04% of the sample shares having it positive. Naturally both t-statistics and Wilcoxon z-value are highly significant in this sub-sample. T-statistic is 6.1827 and Wilcoxon z-value is 5.2113, both being statistically significant at 0.1% level.

The results suggest that even though the large spread change group and illiquid shares sub-sample experienced quite similar decline in their spreads the pre-event illiquid group shares still improved their market depth more. Once again it seems that the spreads can not alone explain the improvement in the liquidity. There may be more to liquidity as the originally illiquid shares were able to take more out of the new system than the group with the most improvement in the spreads. The reason behind that is uncovered here. However, the improvement in market depth goes hand in hand with improvement in trading volumes and that effect in turn explains the difference between the spread decliners and pre-event illiquid group. The same applies with the liquid shares and small spread movers. In that case the small

spread movers has been able to increase their trading more and accordingly their market depths has increased more[10].

The results above then support the theory of the liquidity. The more change in trading volumes and thus liquidity the more improvement in market depths too. That naturally is so because of the fact, the increased trading and deepened market depths are indicators of improved liquidity. Down below in the 4c are presented the results for the sub-samples based on the trading volumes which capture the best the improved liquidity.

Table 4c

Relative Changes in Liquidity Ratios – Based on Improvement in Trading Volumes

In the table are shown relative average changes in the liquidity ratios (formulas 2 and 3 above) between before and after the event. Ratios are calculated from -49 T to -5 T for before sample and from +5 T to +49 T for after sample and DLRs are derived from them. Positive DLR implies greater market liquidity or depth. T-test and Wilcoxon signed rank test for DLRs is conducted with the null hypothesis that the DLR is zero.

	All		Small Change		Large Change	
	N = 108		N = 54		N = 54	
Average DLR	0.71742		0.17831		1.25654	
St.Dev	0.98450		0.85876		0.79186	
Number of positive	88	(81.48%)	34	(62.96%)	54	(100%)
t-stat	5.3550	***	1.5258	'	11.6607	***
Wilcoxon z	6.7027	***	2.2408	*	6.3909	***

' Significant at 10% level
* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

The results are as according to my presumption. Above, it is clearly seen that the improvement in the liquidity ratios and market depth is the greatest with the shares that had largest increase in the terms of trading volume. It is not surprising, as they are measurements of the same thing, i.e. liquidity. However, to fully study the market effects I want to test the sample from the best and least benefited point of view.

[10] In the section 3.3 was presented the overlapping of the samples. Pre-event liquidity based sample overlaps more (57.41%) with the samples that is based on trading volume improvement than the spread based sample, (51.85%). In section 5.1.1 the improvement in trading was largest with the least liquid shares. 85.19% reported positive change in trading on average 6.47 against large spread decliners 81.48% and 6.15. Respectively the small spread movers were able increase trading on average 1.82 (87.04%) against liquid shares' 1.50 and 83.33%.

The results suggest that the market depth of the shares with the least increase in trading would have not change at all or have risen only modestly. However, the average DLR across the sample is slightly positive, 0.1783 with 62.96 percent of the sample shares having it positive. Wilcoxon z-value is 2.2408 indicating evidence of deepened market depth at 5% significance level but the t-statistics is only significant at 10% level providing us with little evidence. As we remember from the previous chapter, even in this sample the overall trading increased on average around 25%. That is sufficient enough to show a weak evidence of deepened market depth even in this sub-sample.

In the group where the increase in trading was largest so is the increase in market depth. The average DLR for that group is 1.25654, all sample shares having it positive. The t-statistic is 11.6607 and Wilcoxon z-values is 6.3905 both being statistically highly significant. The results are of course in this sampling self-evident.

The evidence presented above supports the theory that the spreads are playing a role in the function of liquidity. While some prior studies have failed to show the relations of decreased spreads and increased trading volume, I found strong evidence on the relation. It, however, must be kept in mind that the situation is not quite the same as in e.g. Pacidore (1996) or Ahn et al. (1995). The biggest difference is the quote guarantee as a new feature to the market that promotes automatically the liquidity. Moreover, the inventory trades made by Liquidity Providers may increase the trading. Nevertheless, by controlling the spreads and guaranteeing the quotes the liquidity providing system has clearly succeeded where it suppose to. The all shares sample shows as results of increased trading volume and deepened market depth. The results are all statistically significant.

The results are in accordance with my own presumptions. In addition, they are close to the results of Anand et al. (2005) and other papers on liquidity providing. The originally most liquid shares gained relatively less than less liquid ones. The reasoning is very simple to lead to diminishing spreads. Originally liquid shares experienced relatively smaller decline in their spreads than originally less liquid shares. Accordingly, originally liquid shares experienced less improvement in their trading volumes and vice versa.

Some interesting issues arose from the results. Above it was shown that the changes in liquidity were larger for the originally illiquid shares than for the shares that experienced the

largest decline in spreads and neither the largest spread decliners nor the pre-event illiquid shares were not ultimately the same shares as the ones that increased the trading the most. That would indicate in theory that there may be another factor also that has vitalizing effect on trading besides spreads. Obviously many companies that have engaged in liquidity providing contract may have done other promotion efforts also in order to make their share more attractive to the investors. That in turn may explain the results. But it is possible that the guarantee that the trading can take place in the first place has a role here also. As the Liquidity Providers guarantee that trades can always take place, it should in theory boost trading without the matter of spreads. No trading can take place if the agents, sellers and buyers, are not present on the market at the same time. At least in theory, the quote guarantee on the market could be one explanation in that matter. It certainly leaves room for further studies.

Nevertheless, I was able to create a link between the spreads and liquidity. The general tendency seemed to be that the more improvement in the spreads the more increase in trading and the more increase in trading the more increase in the market depth. The results were most of the part very convincing and statistically significant. Therefore, in the light of the results I would say that the Liquidity Providers have been able to meet the targets they are set to meet. Across all the shares the liquidity has improved to the great extent, originally the most illiquid shares taking the best out of it.

5.2. The RRD Model – A Test for Efficiency

In the previous section I presented evidence of improved liquidity. The theory suggests that improved liquidity should in turn enable investors to incorporate information to the share price more quickly and with greater precision. Therefore, the pricing errors relative to the market index should be smaller due to the fact that both faster adjustment to changes in the market index and smaller firm-specific errors given the information available from the observed prices (see Amihud et Al. 1997).

The Liquidity Providers even further strengthen the signals that can be read on the observed prices. As I discussed in the second chapter, the Liquidity Providers should in theory decrease the affect of asymmetric information as they have to monitor the companies they guarantee very closely. If it was not so, they would not be able to guarantee the required spreads and live another day.

To test whether efficiency has improved, I have used the RRD model introduced in Section 4.2 (above). According to the model, the common one-factor market model (5) residuals should be smaller after improvement in the exchange's trading system.

The results below are very much as anticipated. Most sub-samples experienced a declined in the RRDs. The results support the theory that the market conditions would have been improved along with the Liquidity Providers. However, there are some differences to the presumptions I have made in the course of this paper.

Table 5a

RRD-Model Results – Based on Spread Improvement

RRDs are calculated from the window surrounding the event from -99 to – 10 and from +10 to +99. A two sample t-test assuming unequal variances is conducted for each sub-sample and all shares with the null hypothesis that the difference between sample daily average 90 days before and 90 days after is zero. Wilcoxon z-values are calculated on the paired sample of sample shares. The difference in Average RRD is presented as a percentage decline from the before value.

	All			Small Spread Change			Large Spread Change		
	N = 108			N = 54			N = 54		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Average RRD	0.000894	0.000635	-28.94 %	0.000674	0.000588	-12.80 %	0.001168	0.000702	-39.88 %
St.Dev	0.000440	0.000263	-0.000178	0.000342	0.000340	-0.000002	0.000825	0.000456	-0.000369
t-stat	-5.1042 ***			-1.6973 *			-4.6851 ***		
Number of negative	77 (71.30%)			34 (62.96%)			43 (79.63%)		
Wilcoxon z	4.5241 ***			1.7608 *			4.1975 ***		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Table 5a above presents result for all shares and the shares divided into two sub-samples based on the decline in the spreads. The results suggest that the overall market quality has improved as anticipated. All shares' RRD has decreased 28.94% with 71.30% of all shares reporting decreased RRD. T-statistic for sample RRD is -5.1042 indicating strong evidence of decline. Wilcoxon z-value, 4.5241 for the paired sample, is also significant at 0.1% level. The overall market quality with the LP-shares has indeed improved.

The shares with smallest decline in their spreads show weaker evidence of improved market quality. The sample average RRD has declined about 12.80% with only 62.96% of them having it positive. Both the t-statistic and Wilcoxon z-value are significant at 5% level and the test results can be just accepted with weak evidence of improved market quality.

The shares with the largest change in the spreads show the strongest evidence of improved market quality. Naturally, the market model becomes more accurate model when the spreads decline. In addition, as the spreads are extra costs to the investors I would argue that they are frictions that cause a drift further away from the efficient market hypothesis. The RRD in this group has declined 39.88%. RRD is positive with 79.63% of shares while both the t-statistic, -4.6851 and Wilcoxon z-value, 4.1975, are significant at 0.1% level.

Table 5b

RRD-Model Results – Based on Pre-Event Liquidity

RRDs are calculated from the window surrounding the event date from -99 to – 10 and from +10 to +99. A two sample t-test assuming unequal variances is conducted for each sub-sample and all shares with the null hypothesis that the difference between sample daily average 90 days before and 90 days after is zero. Wilcoxon z-values are calculated on the paired sample of sample shares. The difference in Average RRD is presented as a percentage decline from the before value.

	All			Liquid			Illiquid		
	N = 108			N = 54			N = 54		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Average RRD	0.00089	0.00064	-28.94 %	0.00083	0.00051	-39.42 %	0.00101	0.00078	-22.15 %
St.Dev	0.00044	0.00026	-0.00018	0.00064	0.00025	-0.00039	0.00056	0.00049	-0.00007
t-stat	-5.1042 ***			-4.5738 ***			-2.8430 **		
Number of negative	77 (71.30%)			40 (74.07%)			37 (68.52%)		
Wilcoxon z	4.5241 ***			4.1286 ***			2.4066 **		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

In the table 5b are presented the results for the samples based on the pre-event liquidity. Here we can clearly see that the originally liquid shares report larger relative change than the illiquid shares does. Both sub-samples, however, report enhanced market efficiency. 74.07% of the liquid shares have decline in their RRD and the sample average has diminished about 39.42%. T-statistic for that sample is -4.5738 and Wilcoxon signed rank z-value is 4.1286 both being significant at 0.1% level.

The results with the originally illiquid shares are weaker but nevertheless statistically significant. The sample average has declined about 22.15% with 68.52% of all shares having the RRDs diminished. T-statistic, -2.9488 and Wilcoxon z at are significant at 5% level.

The results here are only partly in line with the theory. Illiquid shares' RRDs before the event are on the higher level than the corresponding RRDs of liquid shares. That means that the assumption of larger error terms with illiquid shares was justified. In addition, I thought that after the event, the market model error terms would decline when shares are traded on more frequent basis and make among other things price discovery more accurate. The results above are in contradiction with my anticipations. I would have expected that originally illiquid shares would have experienced more clear change in their market model error terms. However, only 68.52% of them have experienced decline in RRD as the same number with the most liquid shares 74.07%.

The reasons behind that development are hard to come up with. Generally, I would still think that most illiquid shares would gain the most of any market improvement. In the table 5c below are presented the results for the samples based on the improvement in the liquidity. The results are in line with the results above. The shares that show the most improvement with their liquidity show the least improvement in the market quality.

Table 5c

RRD-Model Results – Based on Improvement in Trading Volumes

RRDs are calculated from the window surrounding the event from -99 to – 10 and from +10 to +99. A two sample t-test assuming unequal variances is conducted for each sub-sample and all shares with the null hypothesis that the difference between sample daily average 90 days before and 90 days after is zero. Wilcoxon z-values are calculated on the paired sample of sample shares. The difference in Average RRD is presented as a percentage decline from the before value.

	All			Small Change			Large Change		
	N = 108			N = 54			N = 54		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
Average RRD	0.000894	0.000635	-28.94 %	0.000809	0.000392	-51.56 %	0.001033	0.000898	-13.06 %
St.Dev	0.000440	0.000263	-0.000178	0.000473	0.000194	-0.000279	0.000732	0.000507	-0.000225
t-stat	-5.1042 ***			-7.7440 ***			-1.4372 '		
Number of negative	77 (71.30%)			45 (83.33%)			32 (59.26%)		
Wilcoxon z	4.5241 ***			5.0929 ***			1.5800 *		

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

The results for the shares that have experienced increase in their trading volumes the most, report only weak evidence of improved market quality if at all. In this case I have to accept the null-hypothesis that the sample average RRD has remained on the same level.

Small change group reports strong evidence of improvement in market quality. The sample average RRD has declined 51.56%. 83.33% of shares in that sample report decline in their RRD. The results are supported by at 0.1% significant level t-statistic of -7.7440 and Wilcoxon z-value of 5.0929.

The results suggest that the market efficiency improvement is largest with the originally more liquid shares and the shares that experienced the least improvement in their liquidity. That really is against what I would have otherwise thought. There are several reasons behind my thoughts. Maybe the most prominent is the fact that the originally most liquid shares were already subject to frequent trading, had lower spreads, are more closely monitored and

information is more easily available to anyone. That means that they are in the first place closer to the efficient environment and that they in theory had less to gain from this new system. On the other hand the least liquid shares before the help of liquidity providers were subject to large spreads and infrequent trading. Accordingly their ability to react to the market moves was weak. However, the more frequently traded shares seem to be able to take the best out of the liquidity providing and even further strengthen their market efficiency.

The results above show the relation between the spreads and RRD-model. The common market model is able to project the actual returns more accurately when the spreads decline. However, in the case of large improvement in the trading volumes the RRD-model results are the weaker the larger the improvement. Explicitly that would mean that improvement in the liquidity would improve market efficiency only a little if at all. Whether or not that is the case, is a subject for closer studies.

The main point, however is, that the results show us without any doubt that Liquidity providing has improved the market efficiency when measured with RRD-model as whole. Any further interpretation of the results is quite difficult for the fact that they contradicts with the theory quite much. The results here certainly leave room for further studies.

5.3. Value of Liquidity

So far in this study I have presented evidence that Liquidity Providers have been able to increase liquidity and enhance the market efficiency. My hypothesis is that investors put value on those improvements. That would be also in accordance to theory I introduced in the chapter 2. The theory of liquidity suggests that as the liquidity improves the expected returns would decline. Therefore, I expect to see a permanent share prices rise after the event. The price rise is expected to be the greater the more improvement in the liquidity.

In the figure 4a below is presented the Cumulative Abnormal Returns for the spread based sub-samples and all shares. In the table 6a below are presented the statistics for the abnormal returns for the 16 days event window, days 0 - 15.

The Cumulative Abnormal Returns keep until the d-day at the ground level as they are supposed to without any external shocks. The price rise starts just after the event day and keeps rising for the first 16 days until they reach their new level and the rise settles. That suggests that the price increase would be permanent and that it is caused by the event under the investigation. In addition, the fact that the price improvement happens after the event there would not be any information leakage before the event or that no one has taken advantage on it. In some cases the price rise starts before the event probably due to the fact that some people are reacting on the event before they should know about it.

In the picture the both spread based sample lines are quite close to each others. And around the whole sample's line. The cumulative abnormal return for all shares in first 16 days is 3.4244% indicating substantial increase in the wealth of existing shareholders. The t-statistic for that period is 2.0354 providing us evidence at the 5% significance level. The test statistics suggest that the abnormal returns for these sub-samples in the 16-days event window would be for small spread change group 2.5825% and the large spread change group 4.2663%. Small spread change groups t-statistic is not significant even at 10% level and will be rejected. The large spread change t-statistic is 2.3288 and significant at 5% level and can just be accepted.

Figure 4a

Cumulative Abnormal Returns – Based on Spread Improvement

In the picture are presented the Cumulative Abnormal Returns for all shares, 54 shares that experienced largest decline in spreads and 54 shares with smallest change in spreads.

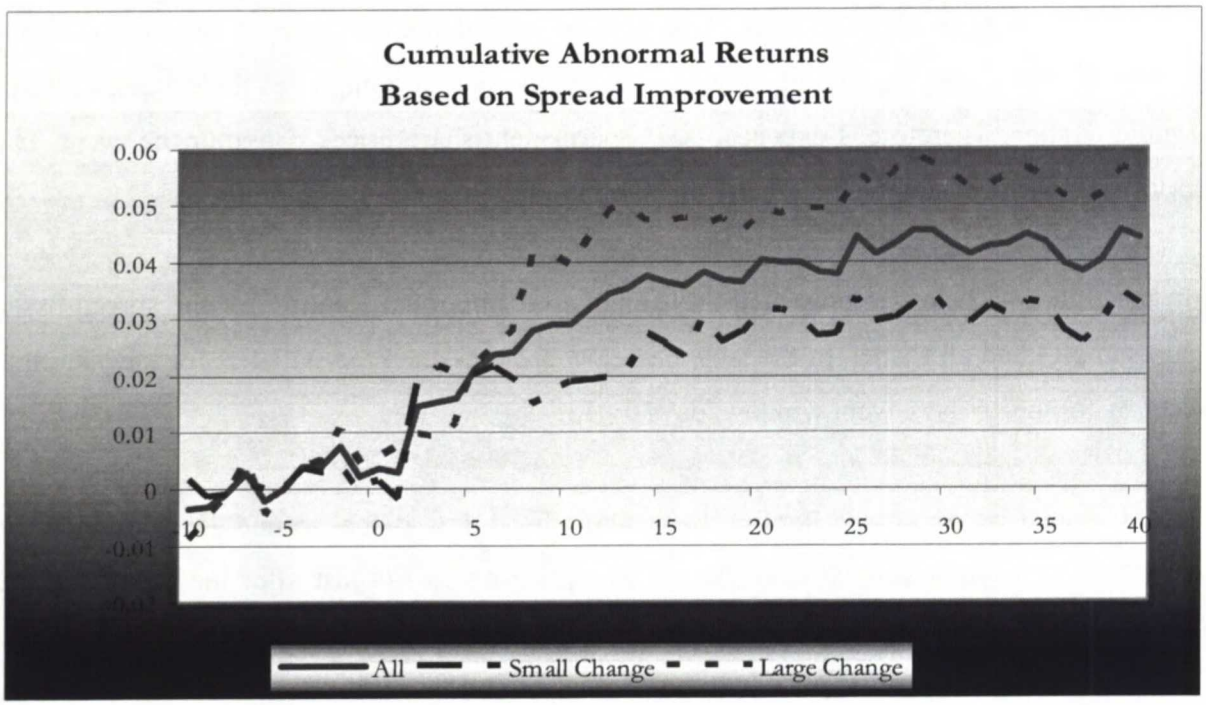

Table 6a

Cumulative Abnormal Returns – Based on Spread Improvement

In the table are presented the statistics for the Daily Abnormal Returns for the Days 0 – 29. T-statistics are for the null-hypothesis that the average daily abnormal return is zero in the event-window.

	All	Small Spread Change	Large Spread Change
	N = 1728	N = 864	N = 864
Average Daily Abnormal Return	0.21402 %	0.16141 %	0.26664 %
St.Dev	0.04372	0.05187	0.04266
t-stat	2.0354 *	0.9151	2.3288 *
CAR Days 0 - 15	3.4244 %	2.5825 %	4.2663 %

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

Figure 4b

Cumulative Abnormal Returns – Based on Pre-Event Liquidity

In the picture are presented the Cumulative Abnormal Returns for all shares, 54 originally most liquid and 54 originally least liquid shares.

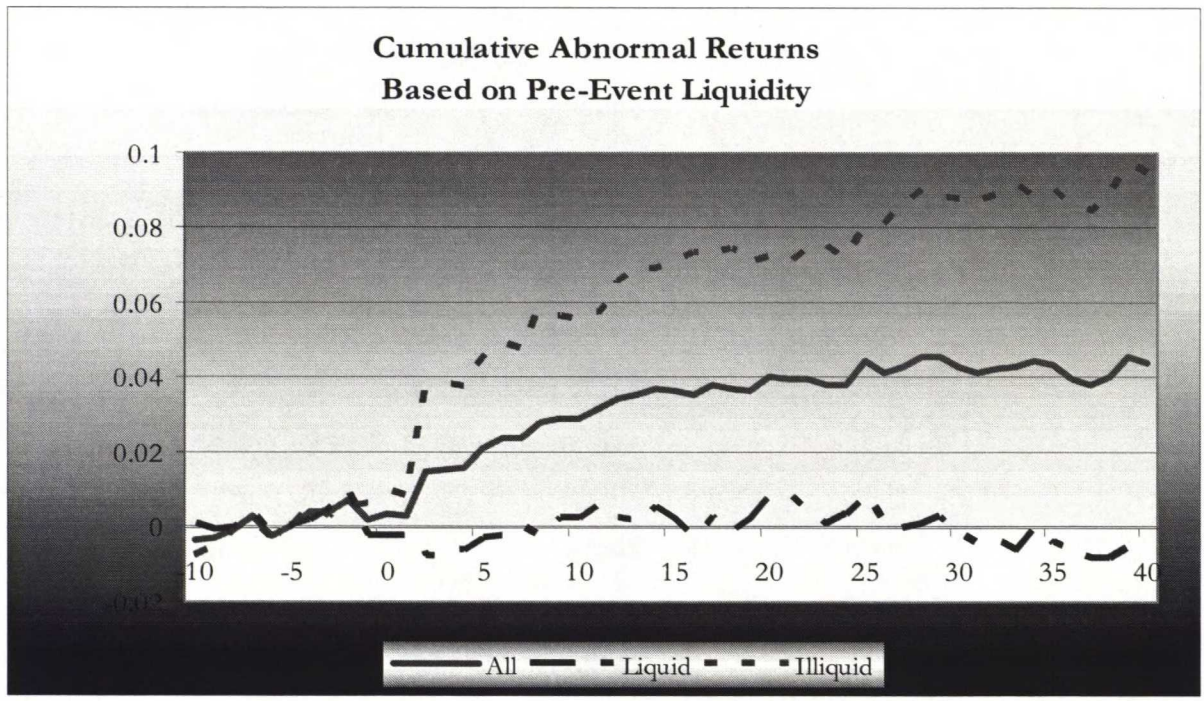

Table 6b

Cumulative Abnormal Returns – Based on Pre-Event Liquidity

In the table are presented the statistics for the Daily Abnormal Returns for the Days 0 – 29. T-statistics are for the null-hypothesis that the average daily abnormal return is zero in the event-window.

	All	Liquid	Illiquid
	N = 1728	N = 864	N = 864
Average Daily Abnormal Return	0.21402 %	0.01839 %	0.40966 %
St.Dev	0.04372	0.02237	0.05760
t-stat	2.0354 *	0.2419	2.0918 *
CAR Days 0 - 15	3.4244 %	0.2943 %	6.5545 %

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

In the table 6b above, are the statistics for the pre-event liquid and illiquid shares. The 54 originally most liquid shares seem to have gained nothing while the 54 least liquid shares seem to have boomed. The least liquid shares reach rapidly their new level around 6-8% higher than prior the event. That is in line with the anticipations. Liquidity of the originally most liquid shares increased only slightly and accordingly there are no abnormal returns in that group. According to test results we can accept the liquid shares' null hypothesis that the daily abnormal returns are zero. Pre-event illiquid shares instead show a total of 6.5545% rise in the share prices during the 16 day event window. The t-statistic for the illiquid shares is 2.0918, which is significant at 5% level.

The results suggest that the pre-event liquid shares have not gained any market value indicating that improvement in the liquidity has not been great enough to increase share prices. Other way around there is no evidence of liquidity premium in the prices of the originally most liquid shares. The result is not surprising, as these shares were already before the event very liquid and easily tradable. Therefore, improvements that Liquidity Providers have brought to them are quite small and investors have not been discounting their prices for illiquidity. As we remember these shares' trading volumes increased only slightly whereas the situation with the originally most illiquid shares was totally different. Accordingly their CAR-graph rises significantly and the price rise is statistically significant. However, neither of these groups correlates very greatly with the sampling based on trading volume increase. Only about 57% of the pre-event illiquid shares belong to the most trading increased group.

Next, I will look into the sampling that in theory should provide us with the strongest evidence of liquidity premium. In the figure 4c below are the Cumulative Abnormal Returns graphs for the samples based on the increase in pre-event trading volumes. It presents the graphs for the shares whose liquidity have increased the most and the ones whose liquidity has increased the least. It is clearly shown in the picture that the shares that experienced the largest change in their trading volumes also experienced the largest price rise. 54 shares with largest trading volumes improvement seem to have gained around 8% whereas shares with the least change in their trading volumes have not gained at all. The results support the theory that investors would put value on improved liquidity.

Figure 4c

Cumulative Abnormal Returns – Based on Improvement in Trading Volumes

In the picture are presented the Cumulative Abnormal Returns for and all shares, 54 shares that have experienced largest improvement in trading volumes and 54 shares with smallest change.

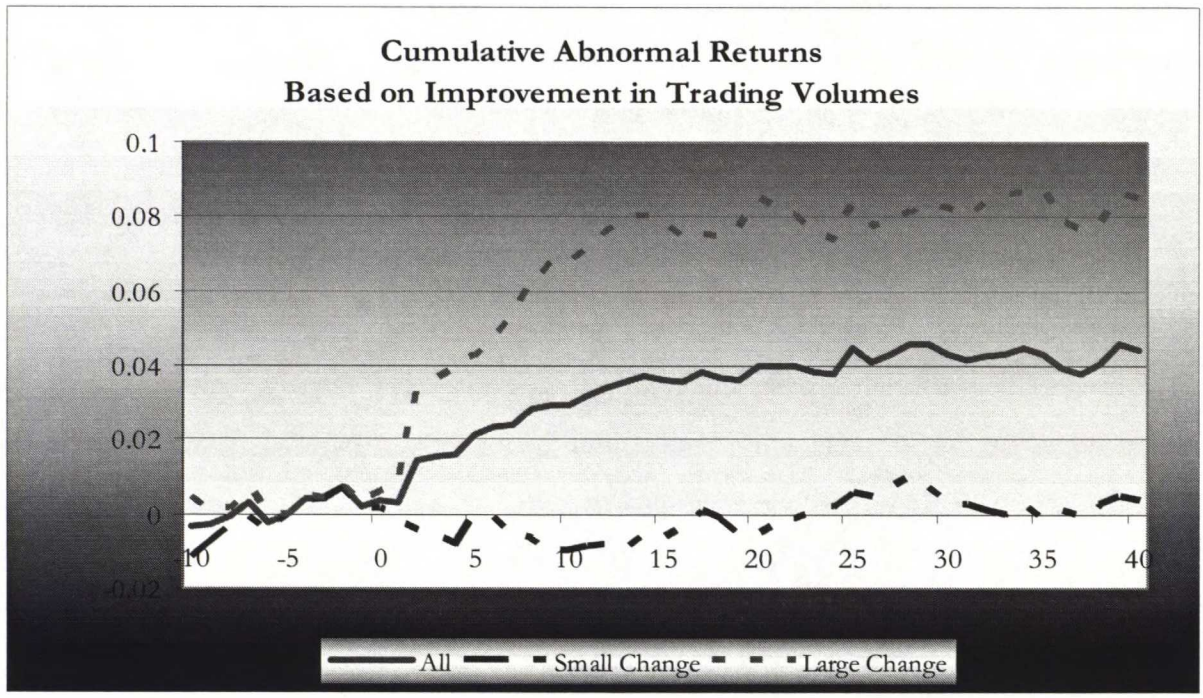

Table 6c

Cumulative Abnormal Returns – Based on Improvement in Trading Volumes

In the table are presented the statistics for the Daily Abnormal Returns for the Days 0 – 29. T-statistics are for the null-hypothesis that the average daily abnormal return is zero in the event-window.

	All	Small Change	Large Change
	N = 1728	N = 864	N = 864
Average Daily Abnormal Return	0.21402 %	-0.05463 %	0.48268 %
St.Dev	0.04372	0.02058	0.05820
t-stat	2.0354 *	- 0.78076	2.4390 **
CAR Days 0 - 15	3.4244 %	-0.8741 %	7.7229 %

* Significant at 5% level.
** Significant at 1% level.
*** Significant at 0.1% level

In the table 6c above are the statistics for the daily abnormal returns for the trading volume change based sub-samples. Not surprisingly we have to accept the null-hypothesis that daily abnormal returns are zero in the case of the shares that experienced the least improvement in their trading volumes. In the figure 4c the sample line seems to be totally unaffected and it follows the x-axis on the graph. That naturally is in accordance with the theory as the improvement in liquidity is quite modest among those shares. Their trading increased only about 24% which clearly is not enough to have positive effect on the prices.

The situation is totally different with the shares whose trading volumes have experienced the largest increase. Those shares seem really to have gained a lot. The CAR line for those shares climbs within 16 days on the new level. The price rise in the graph is around 8% (7.7229% in the 16 days event window) indicating substantial increase in share values. The t-statistic for that price rise is 2.4390 being statistically significant at 1% level. That is very much in line with the prior papers and the theory of liquidity.

The Liquidity Providers at first hand affect on the spreads. The shares which reported the largest improvement in their spreads experienced a price rise whereas the shares whose spreads were affected only a little experienced only a modest price rise if any. As we have seen the spread decline tend to lead to improved liquidity. However, the relative decline in the spreads does not ultimately define the improvement in the liquidity[11].

To sum up, the results are very much as anticipated and are in line with the theory. The results suggest that the investors put value on the improvement in the liquidity. On average the LP-shares gained about 3.1% over the 16-days event window. The improvement was the greatest in the sample that reports the largest increase in its liquidity also. In addition, the results for the pre-event least and most liquid shares sub-samples supports the idea that the most illiquid shares are more likely to experience larger abnormal returns as the changes in their liquidity are bigger. That provides us with evidence of existence of liquidity premium. Investors discount illiquid shares more heavily.

[11] Only 51.85 of the shares that experienced the largest decline in the spreads and 71.43% of the least liquid shares belong to the group of shares that experienced the largest increase in their trading volumes. Accordingly the liquidity improvement was slightly greater in the illiquid shares sub-sample than the large spread change sub-sample.

In the previous chapters, I have already tried to explain the characteristics of the liquid shares compared to illiquid ones. The most prominent difference between these two samples is the trading activity, demand and especially their spreads. With liquid shares there is always enough supply and demand so that the bid and ask prices drive closer to each other and the trading takes place. That in the other hand enables more accurate price discovery and there is no need for liquidity premium in the share prices.

In the case of illiquid shares on the other hand the situation is quite opposite. The low demand and supply makes their liquidity weak and the quotes on the market are often quite far away from each others. That makes a fair price discovery difficult and investors discount the prices due to the difficulties of trading. Liquidity providing brings these illiquid shares so much closer to efficient market hypothesis just enabling the trading. Surely, a rational investor puts value on that improvement, or other way around, stops discounting the prices so heavily.

Finally, the results here are very close to the ones presented in the Anand et al (2005). They also found that the liquid shares gained nothing in terms of abnormal returns. Their liquid shares group posted abnormal returns of 6.19% which is in the same region as my results. The link is not surprising as I have 50 same shares in my sample.

So what comes to the Liquidity Providers, it seems that they bring enhancements on the market that market is willing to valuate. Therefore, from this point's of view, the presence of Liquidity Providers is also justified. The overall market reaction is positive with the shares improving in liquidity the most taking the best out of it. The price rises seem to be statistically significant all shares and the price rise goes hand in hand with the improvement in liquidity providing us with evidence of existence of liquidity premium.

6. CONCLUSION

In this thesis I have studied the impact of Liquidity Providers on market quality at the Helsinki Exchange and Stockholmsbörsen. I find this paper important in at least two ways. The major issue at hand is if the liquidity providing system has succeeded where it is supposed to: has it improved the market quality and increased volume? If so, do the investors put value on this hypothesized market quality improvement? According to the efficient market hypothesis the price discovery should be efficient and accurate despite of any external systems. For the companies contracting Liquidity Providers or planning to do so the results of this study may provide very interesting and important information. The main hypothesis in this paper was that the implementation of LP system in these two Nordic exchanges will improve market quality.

The results are very convincing. Spreads of the participating shares have decreased in 102 out of 108 shares about 78% indicating substantial improvement. However, in this study I had only access to daily closing spreads and therefore, the results have to be contemplated with care. Nevertheless, as the closing spreads have declined and given the characteristics of the liquidity providing system I am willing to argue that the spreads have declined in the other times too.

The main target of the Liquidity Providers is to promote liquidity. Accordingly, I was able to find evidence of increased trading volumes in vast amounts. Not surprisingly, the improvements in trading volumes and market depths were the greatest among the originally least liquid shares and the shares that experienced the most improvement in their spreads. All participating shares reported an average increase of about 396% in trading volumes. The number of shares that experienced an increase in trading volumes was 91, i.e. 84.26% of all shares. In addition, I found evidence of deepened market depths in all my sub-samples. The change in liquidity ratio was positive in 81.48% or 88 out 108 participating shares. Improvements in the liquidity were statistically significant in all sub-samples.

Based on the closing spreads the increase in trading was not entirely attributable to the magnitude of the spread decline. Only 51.65% of the shares were the same in the two groups based on the increase in trading and decline in the spreads. That would partly suggest that

there is more to liquidity providing than just the spread effect. In the theory chapter I introduced various positive effects that Liquidity Providers may bring to the market in accordance to smaller spreads. The most important may be the quote guarantee and the diminishing problems of asymmetric information and fair price discovery in that regard.

According to the efficient market hypothesis there should not be any frictions in the market. To study whether the liquidity and spreads have an influence on the market efficiency I also conducted a test to study the effect of Liquidity Providers on the overall market efficiency. The results for all shares suggest that the market efficiency would have increased. 66.67% or 72 out of all 108 participating shares reported a decrease in their market model error terms. The results, however, claimed that the more liquidity and trading increased, the less of an impact it had on the RRD-model test results indicating that the shares that enjoyed the most improvement in other aspects took the worst out in this respect. The results are confusing as the theory would suggest that the market efficiency improvements would be greatest in the case of the most improvement in liquidity.

A very interesting question for both financial economists and investors is whether investments in improving the market microstructure have positive value. Ceteris paribus, improved liquidity is expected to increase securities values because rational investors discount securities more heavily in the presence of higher trading costs. Accordingly, I tested for any abnormal price behavior as well.

I found evidence of increased prices indicating that the investors really do put value on liquidity. The results in that part support the *Liquidity Premium*-theory. The price rise for all shares was about 3.4% and statistically significant. The magnitude of the spread decline did not seem to play a dominant role in the price rise. The price rise was the greatest among the shares that reported also the greatest improvement in their trading volumes supporting the theory that investors discount the illiquid shares more heavily. Accordingly, the price rise was neither significant nor positive for the pre-event liquid shares.

To sum up, the Liquidity Providers contribute greatly to the market. They succeed where they are supposed to. The results suggest that shares that are subject infrequent trading and large spreads can improve their market conditions by making an agreement with a Liquidity Provider. Small firms are generally the ones subject to liquidity problems and are therefore

the ones that can gain the most out of the liquidity providing system. It should be in any firm's interest that its share is correctly priced on the market. The reasons vary from cost of capital to takeover shelter and management problems. However, the larger companies with smaller liquidity problems can also enjoy the fruits of the liquidity providing system.

Many aspects of the liquidity providing system are not answered here. One very interesting question relates to the effect of the quote guarantee on the market. As the Liquidity Providers guarantee that trades can always take place, it should in theory add value as it reduces the risk. No trading can take place if the agents, sellers and buyers, are not present on the market at the same time. Therefore, part of the improvements in the liquidity must be related to the enabling effect. Another very interesting issue closely related to the one above and the Amihud et al. (1997) and Cooper et al. (1985) is the share price behavior in the bear and bull market or even in some crisis. Finally, at least in theory and in e.g. Dimson (1979), the participating shares' betas may change when the shares undertakes liquidity improving methods. Whether or not this happens in practice, is a question that leaves room for another study.

GLOSSARY OF TERMS

Abnormal Return

When the return on an asset or security is in excess of the expected rate of return

Capital Asset Pricing Model - CAPM

A model that describes the relationship between risk and expected return and that is used in the pricing of risky securities.

$\bar{r}_i = r_f + \beta_i(\bar{r}_M - r_f)$, where r_f = risk free rate

β_i = beta of a security

$\bar{r}_M$ = expected market return

The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by the risk-free (r_f) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (β_i) that compares the returns of the asset to the market over a period of time and to the market premium ($\bar{r}_M - r_f$).

CAR - Cumulative Abnormal Returns

Summation of consecutive abnormal returns over predetermined time period. Based on financial theory CAR is zero if no unexpected external shocks are induced into market. Any deviation of zero means that the security has under or over performed.

Common Market Model

Model is used to estimate the share returns based on market movements.

Explicitly, $R_{jt} = \alpha_j + \beta_j RM_t + \varepsilon_j$, where R_{jt} = estimated security return at time t

β_j = market risk or security beta

RM_t = market index return at time t

ε_j = error term

Efficient Market Hypothesis (EMH)

An investment theory that states that it is impossible to "beat the market" because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. According to the EMH, this means that stocks always trade at their fair value on stock exchanges, and thus it is impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. Thus, the crux of the EMH is that it should be impossible to outperform the overall market through expert stock selection or market timing, and that the only way an investor can possibly obtain higher returns is by purchasing riskier investments.

Liquidity

1. The degree to which an asset or security can be bought or sold in the market without affecting the asset's price. Liquidity is characterized by a high level of trading activity.
2. The ability to convert an asset to cash quickly, simply; ease of trade.

Liquidity Premium

An asset's liquidity premium is a form of compensation for investors who tolerate the extra risk stemming from liquidity risk - compared to that of a risk-free asset - in a given investment.

Liquidity Provider

Liquidity provider guarantees that there are both bid and ask side quotes on the market for the guaranteed security. Moreover the spread must be within 4% calculated from the bid price.

Liquidity Providing

The system where Liquidity Providers help normal trading by guaranteeing quotes on the market within certain limits (see Liquidity Provider).

Liquidity Ratio

Also known as Amivest measure. The measure tells us how big the euro volume of trading needs to be in order to cause a 1% movement of the share price either up or down. A higher LR implies improved liquidity and thus, larger market depth.

Liquidity Risk

The liquidity risk is stemming from the lack of marketability of an investment that cannot be bought or sold quickly enough to prevent or minimize a loss.

LP

See Liquidity Providing

Market Depth

Market depth is the size of an order needed to move the market a given amount. If the market is *deep*, a large order is needed to change the price. Contrast with liquidity, the ease to find a trading partner for a given order.

Market Maker

See Specialist

Market Risk

Market risk is a risk inherent to the entire market or entire market segment. It is also known as "un-diversifiable risk" or "systematic risk."

Relative Residual Dispersion (RRD)

RRD-model measures the market efficiency based on the presumption that the market model becomes a better estimator of share price performance when there is less friction on the market. Implicitly that means that market model error terms will decline as the market efficiency improves.

Risk Premium

The return in excess of the risk-free rate of return that an investment is expected to yield. An asset's risk premium is a form of compensation for investors who tolerate the extra risk - compared to that of a risk-free asset - in a given investment.

Specialist

Specialist is a member of an exchange who acts as a market maker to facilitate the trading of a given stock. The specialist holds an inventory of the share, posts the bid and ask prices, manages limit orders and executes trades. Specialists are also responsible for managing large movements by trading out of their own inventory. If there is a large shift in demand on the buy or sell side, the specialist will step in and sell out of their inventory to meet the demand until the gap has been narrowed.

Spread

The difference between the bid and the ask price of a security or asset.

Small Firm Effect

A theory that suggests that smaller firms, or companies with a small market capitalization, will outperform larger companies. This market anomaly is a factor used to explain superior returns in the Three Factor Model, created by Gene Fama and Kenneth French - the three factors being the market return, companies with high book-to-market values, and small stock capitalization.

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APPENDIX A
Participating Shares

COMPANY	STOCK XNGE
LARGE CAP	
Vostok Nafta SDB	Sto
Meda A	Sto
OMX	Sto
MID CAP	
Industrials	
Aspo Oyj	Hel
Beijer Alma AB	Sto
Lemminkäinen Oyj	Hel
Observer	Sto
Strålfors B	Sto
Studsvik	Sto
Sweco Ab B	Sto
Transcom WorldWide SDB B	Sto
Consumer Discretionary	
Rapala VMC	Hel
Talentum Oyj	Hel
Consumer Staples	
Atria Yhtymä Oyj A	Hel
Cloetta Fazer B	Sto
HK Ruokatalo Group A	Hel
Health Care	
Active Biotech	Sto
Orexo	Sto
Financials	
Fast Partner	Sto
Hagströmer & Qviberg	Sto
Klövern	Sto
Latour A	Sto
Latour B	Sto
LjungbergGruppen AB B	Sto
Öresund, Investmenta B	Sto
Information Technology	
Addtech AB	Sto
IFS B	Sto

COMPANY	STOCK XNGE
SMALL CAP	
Materials	
Profilgruppen B	Sto
Tricorona Mineral Ab B	Sto
Industrials	
Active Capital B	Sto
Beijer Alma Ab B	Sto
BTS Group AB	Sto
Componenta Oyj	Hel
Consilium AB	Sto
Custos	Hel
Efore Oyj	Hel
Etteplan Oyj	Sto
Intellecta AB	Sto
Larox B	Hel
Martela A	Hel
Nefab AB	Sto
OEM International B	Sto
Opcon	Sto
Poolia AB	Sto
Proffice AB	Sto
Raute Oyj A	Hel
SinterCast	Sto
Suomen Helasto Oyj	Hel
G&L Beijer AB	Sto
Consumer Discretionary	
VBG AB	Sto
Vaahto Group A	Hel
Vaahto Group K	Hel
XANO Industri B	Sto
Ab Ångpanneföreningen B	Sto
A-Com	Sto
Borås Wäfveri AB B	Sto
BRIO B	Sto
Cherryföretagen B	Sto
Evia Oyj	Hel
Honkarakenne B	Hel
Netonnet	Sto
Nilörngruppen AB	Sto
Pohj-K.Kirjap. A	Hel
Puuharyhmä	Hel
Wedins Skor & Accessoarer AB	Sto
VLT AB	Sto
Zodiak Television B	Sto
Consumer Staples	
Lännen Tehtaat Oyj	Hel
Suomen Spar A	Hel
Suomen Spar K	Hel

COMPANY	STOCK XNGE
Health Care	
Diamyd Medical B	Sto
Probi	Sto
RaySearch Laboratories B	Sto
Tripep	Sto
Vitrolife	Sto
Financials	
Affärsstrategerna B	Sto
J Tallberg-Kiint. B	Hel
Ledstiernan B	Sto
Novestra	Sto
SSK S.Sääst.Kiint.	Hel
Information Technology	
Aspocomp Group Oyj	Hel
Beijer Electronics	Sto
Connecta AB	Sto
Digital Vision	Sto
Modul 1 Data	Sto
MSC Konsult AB	Sto
MultiQ International	Sto
onetwocom	Sto
PartnerTech	Sto
Prevas AB B	Sto
ProAct IT Group	Sto
Resco AB	Sto
Satama Interactive	Hel
Scribona B	Sto
Solteq Oyj	Hel
Tekla Oyj	Hel
Teleste Oyj	Hel
Teligent AB	Sto
XponCard Group	Sto
Nocom	Sto
Novotek Ab	Sto
Dead as they were	
Sapa AB	Sto
I.A.R. Systems AB	Sto
Daydream Software AB	Sto
Tivox Ab	Sto
Turn It	Sto
TV4 Ab A	Sto
JLT Mobile Computers AB	Sto
HQ Fonder AB	Sto
Frango Ab	Sto

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Moikka,

ohessa on lopputyöni, josta tarvitsen kaksi kopiota (kansiin) sekä irtolehtiversion kirjastoa varten. Olisi tärkeää ja aivan mahtavaa jos painotyö olisi valmis viim. perjantaina ennen puolta päivää. Oheinen versio työstäni sisältää tyhjän sivun sekä kansilehden, että tiivistelmän jälkeen. Ajattelin, että tulee kivemman olonen, enkä tiennyt miten te töitä käsittelette... Palailettehan asiaan pikimmiten jos tulee jotain kommentoitavaa tai kysyttävää!

Ystävällisin terveisin ja kiitos jo etukäteen,

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